Site Characterization Report/Remedial Action Completion Report for Aboveground Storage Tank 426

Area of Interest 6
Marcus Hook Industrial Complex
100 Green Street, Marcus Hook Borough and Lower Chichester Township, Delaware County, Pennsylvania

Site-wide PADEP Facility ID No. 780192
PADEP Incident No. 45597
PADEP Tank Nos. 426A

Evergreen Resources Management

GHD | 1140 Welsh Road Suite 120 North Wales Pennsylvania 19454, United States

11109679 | Report No 3 | May 8 2018

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1. Introduction

This Site Characterization Report (SCR)/Remedial Action Completion Report (RACR) has been prepared for Area of Interest (AOI) 6 at Marcus Hook Refinery Operations. This report has been prepared on behalf of Marcus Hook Refinery Operations, a series of Evergreen Resources Group, LLC (Evergreen) regarding the Sunoco Partners Marketing and Terminals L.P. (SPMT) Marcus Hook Industrial Complex (facility), formerly Marcus Hook Refinery. The facility is located at 100 Green Street in Marcus Hook, Delaware County, Pennsylvania (Figure 1). Sunoco, Inc. (R&M) previously operated the facility, which is currently owned by SPMT. As of December 30, 2013, Evergreen assumed the responsibility for remediation liabilities occurring at the facility on or before April 1, 2013.

One open storage tank related incident occurred prior to April 1, 2013 within AOI 6. This SCR/RACR provides the necessary information to close the incident (as defined as having a release within the berm area) associated with the tank located in AOI 6. The incident addressed in this SCR/RACR is summarized in the table below:

Date of Incident	PADEP Incident Number	Sunoco/ PES Tank Number	Former PADEP Tank Number	Current PADEP Tank Number (PES)	Quantity Released (Gallons)	Description
6/03/1995	45597	426	426A	426A	42,000	Lube Oil

1.1 Site Background and Ownership History

The facility is located on the north bank of the Delaware River in the Borough of Marcus Hook, Delaware County, Pennsylvania, with portions of the facility in Lower Chichester Township, Pennsylvania and Claymont, New Castle County, Delaware. The facility frontage extends approximately 4,800 feet (ft) along the northern banks of the Delaware River. The facility, which is located on industrial property, covers approximately 585 acres of land with access restricted by fencing and security measures. The area surrounding the facility is characterized by a mixture of residential, commercial, recreational, active industrial, and vacant industrial properties and is bordered on the south by the Delaware River (Figure 1).

The facility is currently operated by SPMT which transitioned the former Marcus Hook Refinery into an operation referred to as the SPMT Marcus Hook Industrial Complex (MHIC). Current operation of the facility (24 hours per day) includes the processing and storage of light hydrocarbon products plus support facilities. Support facilities include a flare, a wastewater treatment area, boilers, air compressors, and loading and unloading facilities. SPMT retrofitted the property with new facilities to process, store, chill, and distribute propane and ethane. A portion of the facility known as Phillips Island is occupied by a combined-cycle, co-generation, and natural gas fired power plant owned and operated by the Marcus Hook Energy Center. Sunoco LP maintains a portion of the facility for race fuels (Sunoco Race Fuels). Braskem leases the polypropylene plant (AOI 8) and the propylene splitter at 15-2 (AOI 5) along with various ancillary piping, storage, and loading.

SPMT receives, stores, and fractionates natural gasoline (feedstock), as well as stores and transfers the two fractionation products, pentane (overheads product) and light naphtha (bottoms product) at the depentanizer unit (C5 Splitter) at the MHIC. The products are shipped offsite via truck, pipeline, and/or barge. SPMT also receives, stores, and fractionates a liquefied ethane/propane transmix (feedstock), as well as stores and transfers the two fractionation products, ethane (overheads product) and propane (bottoms product) at the MHIC. SMPT also transports and provides terminalling services for crude oil and refined products at MHIC. Crude oil and refined products (i.e., butane, alkylate, etc.) are received at the MHIC via barge, rail car, pipeline, and/or truck and temporarily stored in bulk storage tanks and caverns to facilitate movements to other transportation systems.

There are several tenants on Site utilizing steam, flare, fuel gas, wastewater treatment, air, water, and other utilities and services. The tenants include fractionation, conversion, and blending operations for a variety of products including Sunoco Race Fuels and power generation.

The facility continues to undergo major redevelopment in association with the Mariner East projects and other infrastructure changes. Much of the infrastructure associated with the former refining operations has been decommissioned and demolished. SMPT's future plans include providing separation of transmix or deethanized natural gas liquids into export grade propane, mixed butane, and natural gasoline.

1.2 Local Geology

GHD presented a detailed discussion of the regional and site-specific geologic conditions relevant to AOI 6 in the Remedial Investigation Report (RIR) (GHD, 2018). In the context of this SCR/RACR, the geologic framework present beneath and in close proximity to AOI 6 can be summarized as follows:

- The facility is located on the up-dip edge of the Coastal Plain Physiographic Province near its contact with the Piedmont Physiographic Province. The Coastal Plain is characterized by relatively flat topography and is underlain by unconsolidated deposits of mud, sand, and gravel. Within the Coastal Plain, sedimentary deposits generally decrease in thickness and "pinch out" against crystalline bedrock of the Piedmont along a transition zone referred to as the "Fall Line," which is generally located along the northern boundary of the facility. The Coastal Plain consists of a seaward-thickening, wedge-shaped sequence of sedimentary deposits that accumulated in a variety of marine and non-marine environments.
- Boring logs reviewed and borings performed as a part of the AOI 6 subsurface characterization indicate that conditions beneath the facility are complex, non-uniform, and reflective of the variability in fluvial depositional environments present through the Quaternary Period.
- Fill has been observed to underlay most of facility at variable extent and thickness ranging from a thin veneer to approximately 25 ft. The fill composition varies, but generally is composed of one or more of the following: silt, sand, gravel, clay, wood fragments, cinders, apparent dredged material, sludge, spent clay, and other construction/demolition or refinery materials. The thickest fill underlies portions of the facility nearest the current Delaware River shoreline that were created by filling and reclaiming former floodplain and estuarine environments through industrialization of the property. The fill within AOI 6 ranges in thickness from 5 to 10 ft. and is

encountered at elevations ranging from 10 ft. above mean sea level (msl) to 0 msl and consists of debris including brick, concrete, and metal.

- Underlying fill at the facility are predominantly muddy sediments previously referred to as the "silty clay layer." These deposits are correlated to Holocene and Pleistocene-age alluvium based on their character and extent. The Holocene-age alluvium is aerially constrained to the Delaware River margin and to the locations of paleovalleys associated with the positions of tributaries (e.g., Linwood, Naamans and Marcus Hook Creeks) draining or that historically drained into it. Because this alluvium represents the flooding and infilling of the Delaware River valley through the Holocene marine transgression, it is by nature vertically restricted to elevations that are below the present-day tidal range. Boring logs describe the Holocene-age alluvium as soft to very soft, dark gray and dark brownish gray clay/silt with abundant organic material including roots, wood, leaves, and occasional layers of sand and peat. Beneath the facility, the Holocene-age alluvium ranges in thickness from a few feet to approximately 35 ft. Beneath AOI 6 the clay ranges in thickness from 5 to 10 ft. and is encountered at elevations ranging from 10 ft. above msl to 10 ft. below msl (NAVD 88).
- Fine-grained deposits of the Pleistocene are common to the facility and generally define the antecedent topography that predated industrialization. Although the upper portion of Pleistocene-age alluvium is lithologically similar to that of the Holocene, it can be distinguished by its firm to stiff consistency, light gray to greenish-gray color, commonality of redoxiomorphic features (e.g., mottling), lower percentage of organic material, and appreciable gravel and pebble content. Based on lithology and stratigraphic position this deposit has been correlated to the Cape May Formation. Beneath the facility, the fine-grained Pleistocene-age alluvium ranges in thickness from a few feet to as much as 10 ft. where present. It is generally thickest beneath uplands that are the erosional remnants of the Cape May Formation terrace and formed the ground surface beneath much of Marcus Hook and the facility. Where missing, this deposit has usually been replaced by Holocene-age alluvium.
- The lowermost lithologic unit beneath the facility is a fairly continuous and predominantly granular deposit (Trenton gravel) that rests unconformably atop bedrock. Stratigraphic position and lithologic correlation suggest that this deposit is Pleistocene in age and may be correlative to the Cape May Formation and also could include minor lithologies of the Pleistocene-age tributary alluvium and/or Pleistocene-age lower terrace deposits. An attempt to distinguish the latter units from the Cape May Formation was not made at the facility and as such the bulk deposit is generally referred to as Pleistocene-age alluvium. Due to its apparent permeability, this unit is interpreted to form the majority of the water-table aquifer at the facility. Lithologies within the Pleistocene-age alluvium include sand, muddy sand, gravelly sand, sandy gravel with occasional cobbles, organic-rich muds, and peat. This portion of Pleistocene-age alluvium (not including the fine-grained cap described in the preceding paragraph) is commonly 10 to 15 ft. thick.
- Bedrock at the facility has been identified through test boring advancement and in outcroppings. Where encountered, a saprolite layer is common that contains a visible rock fabric consistent with published descriptions of Ardentown Granitic Suite crystalline bedrock. Although the bedrock surface generally slopes south and deepens towards the Delaware River, numerous troughs with intervening pinnacles are present. The bedrock troughs appear to reflect the

paleovalleys of most of the major tributary creeks in the area. The elevation of the top of crystalline bedrock (including saprolite) at the facility ranges from approximately 25 ft. (e.g., AOI 5 outcrop) to deeper than -60 ft. NAVD 88 near Dock 2. AOI 6 bedrock is typically encountered at 20 to 30 ft. bgs.

1.3 Local Hydrogeology and Water Bodies

GHD presented a detailed discussion of the site-specific hydrogeological conditions at AOI 6 in the RIR (GHD, 2018). Based on the RIR, the geologic framework present beneath and in close proximity to AOI 6 is interpreted to support the following hydrogeological conditions:

- Due to the highly variable nature of the composition of the unconfined aquifer, k values are expected to also be highly variable.
- Groundwater flow in the unconfined aquifer is generally towards the southeast in the direction of the Delaware River. The gradient across the facility is approximately 0.007 feet per foot (ft/ft). However, some local variability in hydraulic gradient and groundwater flow direction is noted. The groundwater flow pattern appears to be affected by topography associated with former Linwood Creek in AOIs 5 and 2, and by the relocated Middle Creek along its exposed portion in AOIs 5 and 7, where there is potential for groundwater discharge to surface water. Along the eastern boundary of AOI 5, groundwater flow direction is indicated to be east towards the former Linwood Creek, and along the southern AOI 5 boundary some degree of groundwater convergence is apparent along that same feature.
- Groundwater elevations can be locally depressed in areas of active groundwater recovery remediation systems. Groundwater elevations along the tidal Delaware River appear to be influenced by semidiurnal tides, where maximum groundwater fluctuations of approximately 1 foot to 2.7 feet immediately adjacent to the river and 0.1 to 0.15 feet approximately 300 feet inland were observed in monitoring wells during a tidal study conducted by GHD.
- Hydraulic gradients are generally flat (0.001 ft/ft) in the interior of AOI 6, relative to steeper hydraulic gradients observed along the eastern (0.015 ft/ft) and southern (0.006 ft/ft) portions of AOI 6.

Private wells are not present within the facility and the facility is currently connected to a public water/public sewer supply.

1.4 Ecological Evaluation

On September 26, 2016, a survey of endangered, threatened, and special concern species and habitat was conducted by submitting a request to the Pennsylvania Natural Diversity Inventory (PNDI) database. The PNDI search identified no known impact results from the U.S. Fish and Wildlife Service. The PNDI search identified potential threatened and endangered species impacts that required further review by the Pennsylvania Game Commission (PGC) and the Pennsylvania Fish and Boat Commission (PFBC). The PNDI search identified the Osprey (*Pandion haliaetus*), as a threatened species for the PGC. The PFBC listed the Eastern Redbelly Turtle (*Pseudemys rubriventris)* as a threatened species and the following as endangered species: Atlantic Sturgeon (*Acipenser oxyrinchus*) and the Shortnose Sturgeon (*Acipenser brevirostrum).* GHD submitted

consultation letters to the PGC and the PFBC on March 7, 2017 to request further investigation and clearance based on ecological impact potential. Responses indicating that no adverse impacts are expected to species or habitats of special concern were received from PFBC on April 5, 2017 and confirmed by the final PNDI online on March 23, 2017 for PGC. The PNDI search and agency responses are valid for 2 years. All PNDI documentation is included in Appendix A.

The majority of AOI 6 is covered with impervious surfaces, soil or gravel. The soil and gravel covered areas are not likely to serve as a breeding area, migratory stopover or primary habitat for wildlife. The US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) online tool was consulted to assist in identification of wetlands at the site (Appendix A); no wetlands were mapped or identified by the USFWS NWI mapping tool (January 5, 2018). Evergreen intends on completing a habitat assessment to document habitat types present and adjoining AOI 6 and the suitability of these habitats to support species of concern based on the results of the PNDI search even though a no effect letter was received from the PFBC. Evergreen will complete these assessments in accordance with PA Chapter 250.311 and the Pennsylvania Technical Guidance Manual (TGM) by a qualified biologist. The results of this assessment will be included in a future Act 2 submittal.

2. Summary of Investigation

Prior to April 1, 2013, an incident occurred at Tank 426 which remains open in the PADEP Chapter 245 Storage Tank CAP program that required further investigation. . Sampling was conducted in 2016, in conjunction with the Remedial Investigation activities, to provide additional information to support characterization in the vicinity of Tank 426.

Fieldwork conducted as part of the investigation was completed in accordance with Evergreen's Quality Assurance/Quality Control Plan and Field Procedures Manual (Appendix C). The soil samples were analyzed for the Evergreen Petroleum Short List (Table 1). Mercury was also analyzed in these borings as part of the site-wide evaluation of AOI 6 not part of the investigation of Tank 426. The results of the mercury analysis is reported in the RIR. Soil boring logs are included as Appendix D, and the laboratory analytical report is provided as Appendix E. No investigation-derived waste was created during the characterization activities. Soils removed from the sampling locations, with the exception of the sample volume, were returned to the open borehole from which they were sourced. The soil sample locations from all investigations in the vicinity of Tank 426 are shown on Figure 2.

Current and historical analytical results from the 0 to 2 bgs and the 2-15 bg soil intervals and applicable standards are presented in Tables 3a, 3b, 4a and 4b.

2.1 Tank 426 (PADEP Tank 426A, Incident 45597)

Incident number 45597 occurred on June 3, 1995 when lube oil was discovered overflowing from Tank 426, into a secondary containment area. Upon discovery of the overflow, personnel immediately shut off the pump that was transferring into the tank, thereby stopping the overflow. All free product was recovered and reprocessed at the refinery and visually impacted soils were removed. Evergreen reviewed their records in an effort to locate disposal documentation for soil

removal activities. All available disposal records were searched by Stantec personnel for any information relating to disposal of soil for all historic tank releases. No disposal information was identified despite their best efforts. During the 2016/2017 characterization activities, 3 soil borings (AOI6-BH-16-005, AOI6-BH-16-006, and AOI6-BH-16-007) were completed to characterize soils in the Tank 426 area. Samples from these borings were analyzed for the COCs in Table 1. Mercury was also analyzed in these borings as part of the site-wide evaluation of AOI 6 not part of the investigation of Tank 426. The results of the mercury analysis is reported in the RIR. Concentrations of COCs listed on Table 1 were not detected above the non-residential MSC and the numeric SSS (lead) in any of the soil samples collected from these borings with the exception of lead in AOI 6-BH-16-006, which exceeded the soil-to-groundwater MSC in the 2-15 foot interval.

3. Quality Assurance/Quality Control

All fieldwork conducted as part of the site characterization activities was performed in accordance with the methods outlined in Appendix C, Evergreen Field Procedures. Methods established by Evergreen to examine data quality are outlined in the Evergreen Data Usability Standard Operating Procedure (SOP). An assessment of analytical data collected as part of this investigation under the SOP is also included in the AOI 6 RIR. The following sections describe specific aspects of quality assurance/quality control procedures that pertain to the activities outlined in this report.

3.1 Equipment Decontamination

All sampling equipment was either dedicated or decontaminated in accordance with the field sampling procedures to prevent cross-contamination. Prior to sampling, the equipment was decontaminated with successive rinses of detergent, potable water, and distilled water.

3.2 Equipment Calibration

Air quality monitors used for both air monitoring and soil screening were calibrated prior to use. Both a zero calibration and a span calibration using gases of known concentration as recommended by the manufacturer (i.e., 100 parts per million by volume [ppm_v] isobutylene for the photoionization sensor) were performed.

3.3 Sample Preservation

Samples were placed directly into chemically preserved and/or non-preserved glassware provided by the analytical laboratory, as appropriate. All samples were preserved and shipped at a temperature of approximately 4°Celsius (C) or less by application of ice prior to shipment to the analytical laboratory. This temperature was maintained during shipment by placing ice in zip-top bags above, around, and below the sample containers.

3.4 Documentation

Chain-of-custody forms were maintained throughout the sampling program to document sample acquisition, possession, and analysis. Chain-of-custody documentation accompanied all samples

from the field to the laboratory. Each sample was assigned a unique identifier that was recorded in the field notes as well as on the chain-of-custody document.

4. Selection of Remedial Standards

All soil results were screened using a multi-step process, as described in this section. Soil results were first screened against the PADEP non-residential, used aquifer (TDS <2,500 micrograms per liter [µg/l]) MSCs developed by the PADEP to implement the SHS. The following process was used to select the soil SHS for each COC:

- The highest value of either 100 times the groundwater MSC or the generic value MSC was selected to represent the soil to groundwater numeric value.
- The selected used aquifer, non-residential soil to groundwater numeric value was then compared with the non-residential direct contact value (0 to 2 feet or 2 to 15 ft. bgs, as applicable).
- The more stringent of the soil to groundwater value and the direct contact value was selected as the soil MSC, otherwise referred to as the SHS MSC, or simply as the SHS, for initial comparison of soil sample results.

An exception to this soil screening process exists for lead. On February 24, 2015, Evergreen submitted a Human Health Risk Assessment Report to PADEP which presented the development of a risk-based SSS for lead in soil. In a letter dated May 6, 2015, PADEP approved the report, and a non-residential direct contact site-specific numerical standard for lead of 2,240 mg/kg was established. This SSS is used in place of the default 0 to 2 ft. bgs direct contact standard for lead.

5. Attainment of Remediation Standards

Attainment of remediation standards will be demonstrated in this section, and selected remediation standards will apply within the secondary containment area. Analytical results and applicable standards are presented in Tables 3a, 3b, 4a, and 4b. The tank incident discussed below is not known to have impacted groundwater. Evergreen will pursue attainment for groundwater through the Act 2 process.

5.1 Tank 426 (Incident 45597): Non-Residential Statewide Health Standard and Site-Specific Standard

Sampling from soil borings BH-16-005, BH-16-006, and BH-16-007 was conducted to characterize this release. Samples from these borings were analyzed for the COCs in Table 1. Mercury was also analyzed in these borings as part of the site-wide evaluation of AOI 6 not part of the investigation of Tank 426. The results of the mercury analysis is reported in the RIR. All of the soil samples met the SHS and numeric SSS (lead) with the exception of lead in AOI 6-BH-16-006, which exceeded the soil-to-groundwater MSC in the 2-15 foot interval. Attainment of the numeric SSS for lead had been demonstrated for soils for Tank 426. Concentrations of all of the COCs met the applicable non-residential direct contact MSCs, therefore, the direct contact pathway is considered incomplete.

The soil-to-groundwater pathway is being addressed in the AOI 6 RIR. There are no occupied buildings in AOI 6 which do not already have vapor mitigation measures in place (Building 10-PDC-104), so indoor air was not evaluated during the SCR activities. Building 10-PDC-104 was constructed from a blast proof sea container; it has a solid metal floor and has passive venting under the floor, and all penetrations of the shell are on the sides of the structure.

The selected remediation standards for soil have been attained, therefore, the remedial action for Tank 426 is complete.

6. Post-Remedial Measures

No additional measures are required in order to maintain attainment of the selected remediation standards in soil associated with Tank 426. The tank incident is not known to have impacted groundwater. Evergreen will pursue attainment for groundwater through the Act 2 process.

Currently, the vapor intrusion pathway is incomplete because of the lack of receptors (occupied buildings) in the Tank 426 area. In order to assure that this pathway remains incomplete, an institutional/engineering control will be established in which any future occupied buildings constructed in the Tank 426 area will contain vapor mitigation control.

The engineering/institutional control described herein will be formalized in an environmental covenant for the Philadelphia Refinery Complex.

7. Conclusions

Through site characterization performed as part of product release investigations and through additional sampling conducted during the AOI 6 RIR, characterization and delineation of this AOI 6 open incident is considered complete. Additional information about AOI 6, including a comprehensive conceptual site model, is available in the RIR recently submitted under the Act 2/One Cleanup Program (GHD, 2018).

Based on the soil results described in this report, the site characterization is complete. Within the tank secondary containment area, concentrations of COCs in soils have been delineated to the selected remediation standard. Attainment of SHS has been demonstrated for all COCs that are below the SHS. Attainment of SHS has been demonstrated for the majority of the COCs. Attainment of numeric SSS for lead has been demonstrated.

No further action in association with this open incident is warranted, and Evergreen requests approval of this SCR/RACR and the closure of incident 45597 for Tank 426.

8. References

Department of Environmental Protection, Bureau of Environmental Cleanup and Brownfields (2012). Closure Requirements for Aboveground Storage Tank Systems. Technical Guidance Number 263-4200-001, 54p.

Department of Environmental Protection, Bureau of Waste Management (2002). Pennsylvania Code, Title 25. Environmental Protection, Chapter 245. Administration of the Storage Tank and Spill Prevention Program. Commonwealth of Pennsylvania, p. 48-66.2.

Department of Environmental Protection, Bureau of Land Recycling and Waste Management (2002). Pennsylvania Code, Title 25. Environmental Protection, Chapter 250. Administration of Land Recycling Program. Commonwealth of Pennsylvania, p.56-67.

GHD (2016). Remedial Investigation Report, Area of Interest 6, Marcus Hook Industrial Complex, Marcus Hook, Pennsylvania.

Pennsylvania Department Of Environmental Protection, Land Recycling Program (2016). Statewide Health Standards, Table 1 – Medium Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater. http://files.dep.state.pa.us/EnvironmentalCleanupBrownfields/LandRecyclingProgram/LandRecyclingProgramPortalFiles/SWHTables-2016/Table%201.pdf

Pennsylvania Department of Environmental Protection, Land Recycling Program (2016). Statewide Health Standards, Table 2 – Medium Specific Concentrations (MSCs) for Inorganic Regulated Substances in Groundwater. http://files.dep.state.pa.us/EnvironmentalCleanupBrownfields/LandRecyclingProgram/LandRecyclingProgramPortalFiles/SWHTables-2016/Table%202.pdf

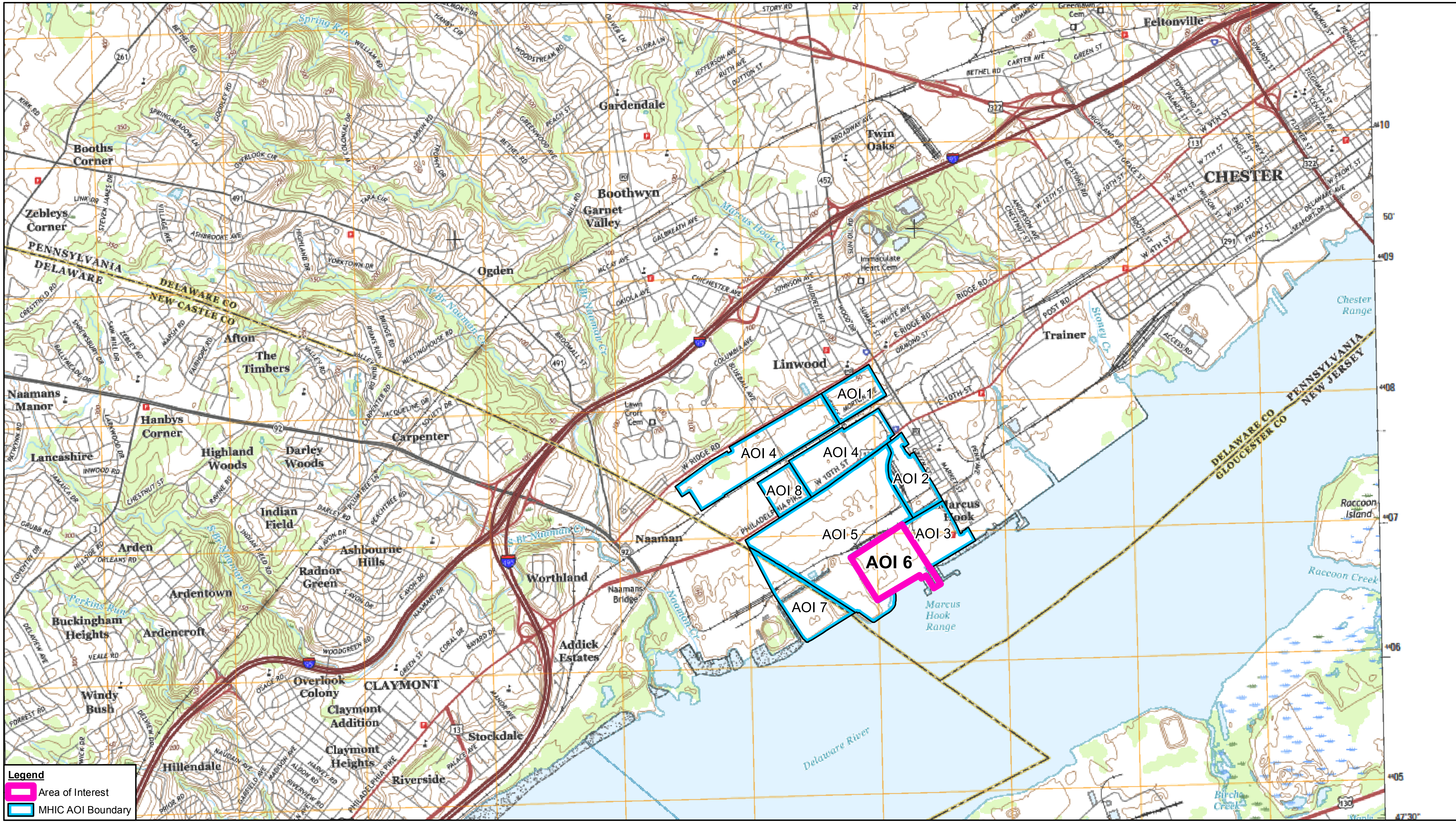
Pennsylvania Department of Environmental Protection, Land Recycling Program (2016). Statewide Health Standards, Table 3a – Medium-Specific Concentrations (MSCs) For Organic Regulated Substances In Soil: Direct Contact Numeric Values. http://files.dep.state.pa.us/EnvironmentalCleanupBrownfields/LandRecyclingProgram/LandRecyclingProgramPortalFiles/SWHTables-2016/Table%203a.pdf

Pennsylvania Department of Environmental Protection, Land Recycling Program (2016). Statewide Health Standards, Table 3b – Medium-Specific Concentrations (MSCs) For Organic Regulated Substances In Soil: Soil To Groundwater Numeric Values. http://files.dep.state.pa.us/EnvironmentalCleanupBrownfields/LandRecyclingProgram/LandRecyclingProgramPortalFiles/SWHTables-2016/Table%203b.pdf

Pennsylvania Department of Environmental Protection, Land Recycling Program (2016). Statewide Health Standards, Table 4a – Medium-Specific Concentrations (MSCs) for Inorganic Regulated Substances in Soil: Direct Contact Numeric Values. http://files.dep.state.pa.us/EnvironmentalCleanupBrownfields/LandRecyclingProgram/LandRecyclingProgramPortalFiles/SWHTables-2016/Table%204a.pdf

Pennsylvania Department of Environmental Protection, Land Recycling Program (2016). Statewide Health Standards, Table 4b – Medium-Specific Concentrations (MSCs) for Inorganic

Regulated Substances in Soil: Soil to Groundwater Numeric Values. http://files.dep.state.pa.us/EnvironmentalCleanupBrownfields/LandRecyclingProgram/LandRecyclingProgramPortalFiles/SWHTables-2016/Table%204b.pdf



Source: Topographic basemap produced by United States Geological Survey

0 1,000 2,000 3,000
Feet

Coordinate System:
NAD 1983 StatePlane Pennsylvania
South FIPS 3702 Feet

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EVERGREEN RESOURCES MANAGEMENT
AOI 6 MARCUS HOOK INDUSTRIAL COMPLEX
SCR - AOI 6

SITE LOCATION

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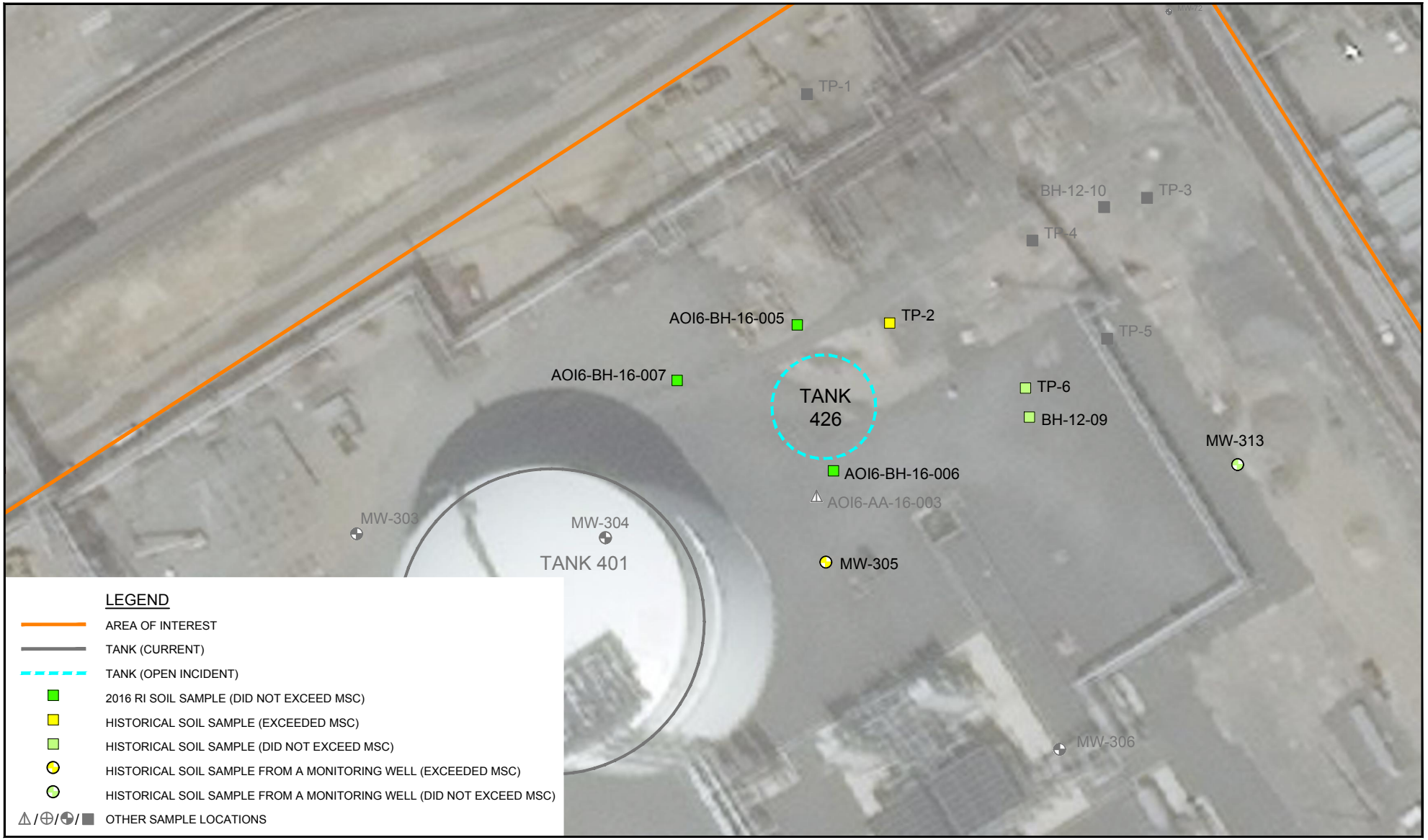
Jan 19, 2018

FIGURE 1

GIS File: 11109679-00(003)GIS-OT001



Source: TERRASERVER, 2016 (IMAGE DATED 08/29/2016).

0 40 80ft

Coordinate System:
PENNSYLVANIA SOUTH
STATE PLANE NAD83 FEET

EVERGREEN RESOURCES MANAGEMENT
MARCUS HOOK INDUSTRIAL COMPLEX
SCR - AO1 6

11109679-00

Mar 26, 2018

SURFACE SOIL SAMPLE LOCATIONS AND RESULTS

FIGURE 2

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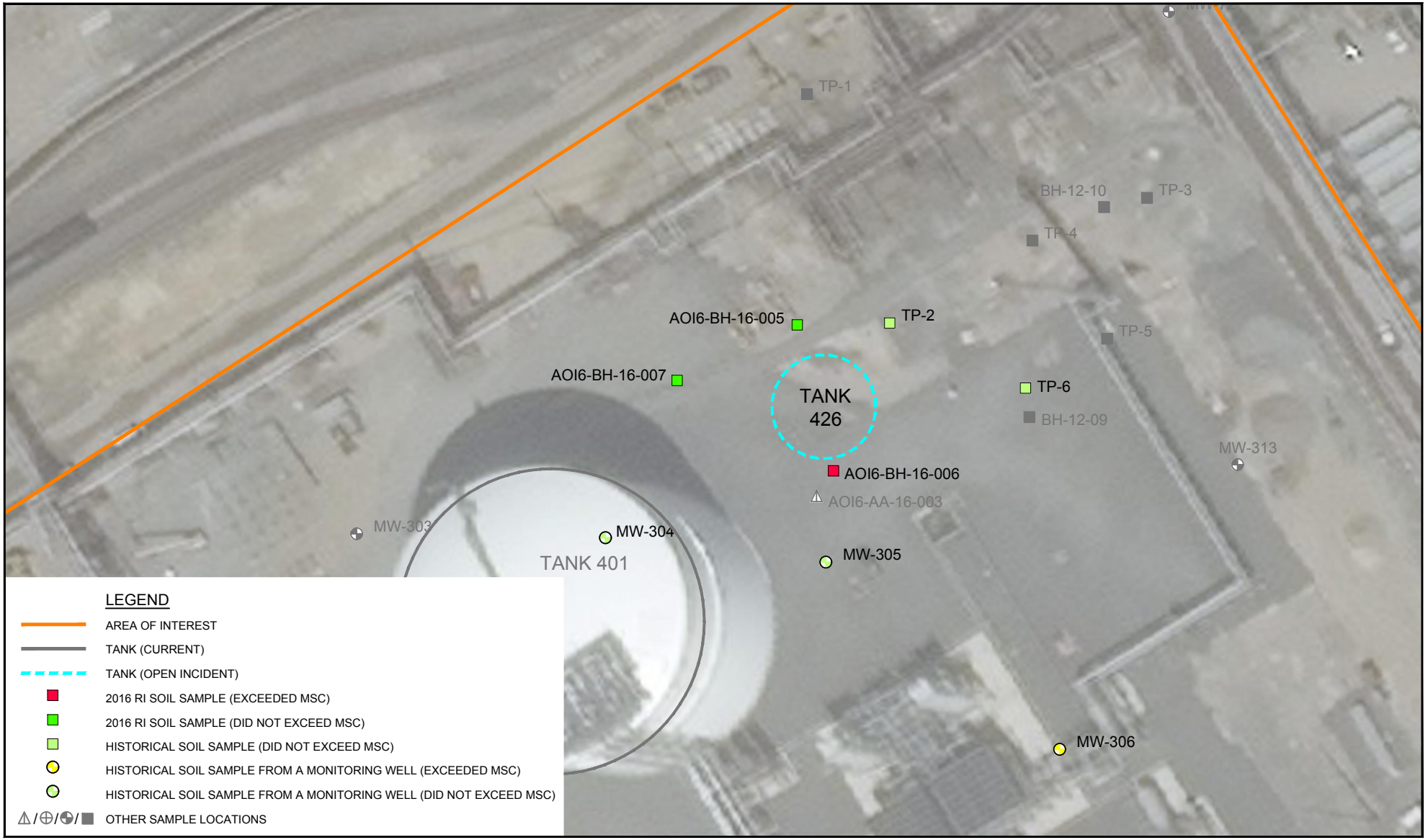

Source: TERRASERVER, 2016 (IMAGE DATED 08/29/2016).

0 40 80ft

Coordinate System:
PENNSYLVANIA SOUTH
STATE PLANE NAD83 FEET

EVERGREEN RESOURCES MANAGEMENT
MARCUS HOOK INDUSTRIAL COMPLEX
SCR - AO1 6

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Mar 23, 2018

SUB-SURFACE SOIL SAMPLE LOCATIONS AND RESULTS

FIGURE 3

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Table 1

Constituents of Concern
Evergreen Petroleum Short List
AOI 6 Site Characterization Report
Marcus Hook Industrial Complex

Volatile Organic Compounds	**CAS No.**
Benzene	71-43-2
Cumene	98-82-8
Dichloroethane, 1,2-	107-06-2
Ethylbenzene	100-41-4
Ethylene Dibromide	106-93-4
Methyl tert butyl ether	1634-04-4
Toluene	108-88-3
Trimethylbenzene, 1,2,4-	95-63-6
Trimethylbenzene, 1,3,5-	108-67-8
Xylenes	1330-20-7
Semi Volatile Organic Compounds	**CAS No.**
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo(a)pyrene	50-32-8
Benzo(b)fluroranthene	205-99-2
Benzo(g,h,i)perylene	191-24-2
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0
Metals	**CAS No.**
Lead	7439-92-1

Notes:

1. Constituents are from Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E (pgs. 29-30) of PADEP Document, Closure Requirements for Underground Storage Tank Systems, effective April 1, 1998 and the March 18, 2008 revised PADEP Petroleum Short List. In May 2009, two additional COCs, 1,2,4-trimethylbenze (1,2,4-TMB) and 1,3,5-trimethylbenzene (1,3,5-TMB), were added to the list of COCs by Evergreen based on the PADEP's revisions to the petroleum short list of compounds and at the request of the PADEP. The COC listing for groundwater was also revised in 2012 to follow the soil COC listing.

Table 2

Characterization Activities
AOI 6 Site Characterization Report
Marcus Hook Industrial Complex

Location ID	Location Rationale	Media	Surface Soil Sample Collected (0-2 ft. bgs)	Subsurface Soil Sample Collected (>2 ft. bgs)	Groundwater Sample Collection	Analyte List	Used for Evaluation of Regulated Tank Incident
AOI6-BH-16-005	Tank 426 Investigation	Soil	X	X	--	Evergreen Petroleum Short List COCs	YES
AOI6-BH-16-006	Tank 426 Investigation	Soil	X	X	--	Evergreen Petroleum Short List COCs	YES
AOI6-BH-16-007	Tank 426 Investigation	Soil	X	X	--	Evergreen Petroleum Short List COCs	YES

Table 3a

2016 Soil Analytical Results Summary (0-2 feet)
AOI 6 Site Characterization Report
Marcus Hook Industrial Complex

Sample Location				AOI6-BH-16-005	AOI6-BH-16-006	AOI6-BH-16-007
Sample Date				22-Apr-16	22-Apr-16	22-Apr-16
Sample ID				BH-16-005-0-2-SOIL	BH-16-006-0-2-SOIL	BH-16-007-0-2-SOIL
Sample Depth				0 - 2 ft	0 - 2 ft	0 - 2 ft
Sampling Company				GHD	GHD	GHD
Laboratory Sample ID		A	B	8347275	8347277	8347279
	Units	DC MSC-PA	SHS MSC-PA			
Volatile Organic Compounds						
BENZENE	mg/kg	290[A]	0.5[B]	ND (0.006) (0.0005)	0.007 (0.0005)	ND (0.24) (0.0005)
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7[A]	0.005[B]	*ND (0.006)* (0.001)	*ND (0.006)* (0.001)	*ND (0.24)* (0.001)
1,2-DICHLOROETHANE (EDC)	mg/kg	86[A]	0.5[B]	ND (0.006) (0.001)	ND (0.006) (0.001)	ND (0.24) (0.001)
ETHYLBENZENE	mg/kg	890[A]	70[B]	ND (0.006) (0.001)	0.007 (0.001)	ND (0.24) (0.001)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000[A]	2500[B]	ND (0.006) (0.001)	0.005 J (0.001)	ND (0.24) (0.001)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600[A]	2[B]	ND (0.006) (0.0005)	ND (0.006) (0.0005)	ND (0.24) (0.0005)
TOLUENE	mg/kg	10000[A]	100[B]	ND (0.006) (0.001)	0.016 (0.001)	ND (0.24) (0.001)
1,2,4-TRIMETHYLBENZENE	mg/kg	560[A]	35[B]	ND (0.006) (0.001)	0.096 (0.001)	ND (0.24) (0.001)
1,3,5-TRIMETHYLBENZENE	mg/kg	10000[A]	210[B]	ND (0.006) (0.001)	0.033 (0.001)	ND (0.24) (0.001)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000[A]	1000[B]	ND (0.006) (0.001)	0.053 (0.001)	ND (0.24) (0.001)
Semi-Volatile Organic Compounds						
ANTHRACENE	mg/kg	190000[A]	350[B]	1.0 (0.003)	1.9 (0.003)	0.32 (0.003)
BENZO(A)ANTHRACENE	mg/kg	130[A]	130[B]	3.6 (0.003)	6.9 (0.003)	0.45 (0.003)
BENZO(A)PYRENE	mg/kg	12[A]	12[B]	3.0 (0.003)	3.1 (0.003)	0.34 (0.003)
BENZO(B)FLUORANTHENE	mg/kg	76[A]	76[B]	3.6 (0.003)	4.6 (0.003)	0.19 (0.003)
BENZO(G,H,I)PERYLENE	mg/kg	190000[A]	180[B]	1.7 (0.003)	1.8 (0.003)	0.29 (0.003)
CHRYSENE	mg/kg	760[A]	230[B]	3.4 (0.003)	17 (0.003)	0.86 (0.003)
FLUORENE	mg/kg	130000[A]	3800[B]	0.33 (0.003)	1.7 (0.003)	0.70 (0.003)
NAPHTHALENE	mg/kg	760[A]	25[B]	0.15 (0.003)	1.9 (0.003)	0.19 (0.003)
PHENANTHRENE	mg/kg	190000[A]	10000[B]	3.3 (0.003)	11 (0.003)	1.2 (0.003)
PYRENE	mg/kg	96000[A]	2200[B]	5.8 (0.003)	9.6 (0.003)	1.6 (0.003)
Metals						
LEAD	mg/kg	2240[C]	450[B], 2240[C]	85.3 (0.510)	264 (0.510)	72.1 (0.510)

2016 Soil Analytical Results Summary (0-2 feet)
AOI 6 Site Characterization Report
Marcus Hook Industrial Complex

Notes:

DC MSC-PA	PADEP, August 2016 Direct Contact Medium Specific Concentrations.
A	Medium-Specific Concentrations (MSCs) for Organic/Inorganic Regulated Substances in Soil - Direct Contact - Used Aquifer - Non-Residential Surface Soil (0-2 ft). Lead value is the site-specific standard.
SHS MSC-PA	PADEP, August 2016 Statewide Health Standards, Medium Specific Concentrations.
B	PADEP Used Aquifer - Non-Residential Statewide Health Standards (0-2 ft bgs).
SSS	Site Specific Standard.
C	PADEP Non-Residential Site Specific Standard (0-2 ft bgs).
6.5 [A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.50)	Laboratory reporting limit was greater than the applicable standard.
ND (0.004) (0.0005)	Analyte was not detected at a concentration greater than the laboratory reporting limit. The first value in parenthesis is the reporting limit. The method detection limit is shown in the second set of parenthesis.
0.140 (0.003)	The first value is the detected concentration. The second value is the method detection limit.
-	Parameter not analyzed / not available.
J	Indicates an estimated value.
ft bgs	feet below ground surface.
mg/kg	milligrams per kilogram.

Analytical data for this table obtained from Stantec database in 2016/2017.

Table 3b

Historical Soil Analytical Results Summary (0-2 feet)
AOI 6 Site Characterization Report
Marcus Hook Industrial Complex

Sample Location				BH-12-09	MW-304	MW-305	MW-313	TP-2	TP-6
Sample Date				8-May-12	12-Apr-12	11-Apr-12	10-Apr-12	9-Jul-12	9-Jul-12
Sample ID				BH-12_09_1.5-2	MW-304@0-1'	MW-305@1.5-2'	MW-313@0-2'	TP-2_.5-1	TP-6_.5-1
Sample Depth				1.5 - 2 ft	0 - 1 ft	1.5 - 2 ft	0 - 2 ft	0.5 - 1 ft	0.5 - 1 ft
Laboratory Sample ID		A	B	6647507/6670146	6617754	6617752	6617747	6714795	6714791
	Units	DC MSC-PA	SHS MSC-PA						
Volatile Organic Compounds									
BENZENE	mg/kg	290[A]	0.5[B]	ND (0.030) (0.0005)	ND (0.005) (0.0005)	ND (0.008) (0.0005)	ND (0.001) (0.0005)	ND (0.005) (0.0005)	ND (0.005) (0.0005)
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7[A]	0.005[B]	*ND (0.061)* (0.001)	ND (0.005) (0.001)	*ND (0.008)* (0.001)	ND (0.002) (0.001)	ND (0.005) (0.001)	ND (0.005) (0.001)
ETHYLBENZENE	mg/kg	890[A]	70[B]	ND (0.061) (0.001)	ND (0.005) (0.001)	ND (0.008) (0.001)	ND (0.002) (0.001)	ND (0.005) (0.001)	ND (0.005) (0.001)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000[A]	2500[B]	ND (0.061) (0.001)	ND (0.005) (0.001)	ND (0.008) (0.001)	0.012 (0.001)	ND (0.005) (0.001)	ND (0.005) (0.001)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600[A]	2[B]	ND (0.030) (0.0005)	ND (0.005) (0.0005)	ND (0.008) (0.0005)	ND (0.001) (0.0005)	ND (0.005) (0.0005)	ND (0.005) (0.0005)
NAPHTHALENE	mg/kg	760[A]	25[B]	-	-	-	-	-	-
TOLUENE	mg/kg	10000[A]	100[B]	ND (0.061) (0.001)	ND (0.005) (0.001)	ND (0.008) (0.001)	0.007 J (0.001)	ND (0.005) (0.001)	ND (0.005) (0.001)
1,2,4-TRIMETHYLBENZENE	mg/kg	560[A]	35[B]	0.21 J (0.001)	ND (0.005) (0.001)	0.082 (0.001)	0.030 (0.001)	ND (0.005) (0.001)	ND (0.005) (0.001)
1,3,5-TRIMETHYLBENZENE	mg/kg	10000[A]	210[B]	0.24 J (0.001)	ND (0.005) (0.001)	0.046 (0.001)	ND (0.002) (0.001)	ND (0.005) (0.001)	ND (0.005) (0.001)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000[A]	1000[B]	0.16 J (0.001)	ND (0.005) (0.001)	0.021 (0.001)	0.025 (0.001)	ND (0.005) (0.001)	ND (0.005) (0.001)
Semi-Volatile Organic Compounds									
ANTHRACENE	mg/kg	190000[A]	350[B]	2.0 (0.003)	0.40 (0.003)	0.82 (0.003)	0.26 J (0.003)	ND (0.19) (0.003)	ND (0.18) (0.003)
BENZO(A)ANTHRACENE	mg/kg	130[A]	130[B]	1.4 (0.003)	0.45 (0.003)	1.8 (0.003)	0.26 J (0.003)	0.67 (0.003)	ND (0.18) (0.003)
BENZO(A)PYRENE	mg/kg	12[A]	12[B]	1.3 (0.003)	0.54 (0.003)	1.1 (0.003)	0.34 (0.003)	1.5 (0.003)	0.20 (0.003)
BENZO(B)FLUORANTHENE	mg/kg	76[A]	76[B]	1.3 (0.003)	1.0 (0.003)	1.4 (0.003)	0.33 (0.003)	0.6 (0.003)	ND (0.18) (0.003)
BENZO(G,H,I)PERYLENE	mg/kg	190000[A]	180[B]	1.1 (0.003)	0.76 (0.003)	0.87 (0.003)	1.4 (0.003)	3.5 (0.003)	0.22 (0.003)
CHRYSENE	mg/kg	760[A]	230[B]	3.2 (0.003)	0.77 (0.003)	5.0 (0.003)	2.2 (0.003)	1.6 (0.003)	0.21 (0.003)
FLUORENE	mg/kg	130000[A]	3800[B]	5.0 (0.003)	ND (0.19) (0.003)	1.4 (0.003)	0.14 J (0.003)	ND (0.19) (0.003)	ND (0.18) (0.003)
NAPHTHALENE	mg/kg	760[A]	25[B]	2.7 (0.003)	0.33 (0.003)	2.4 (0.003)	0.13 J (0.003)	ND (0.19) (0.003)	ND (0.18) (0.003)
PHENANTHRENE	mg/kg	190000[A]	10000[B]	7.9 (0.003)	0.44 (0.003)	9.5 (0.003)	0.29 J (0.003)	0.49 (0.003)	0.21 (0.003)
PYRENE	mg/kg	96000[A]	2200[B]	5.4 (0.003)	0.81 (0.003)	7.5 (0.003)	3.0 (0.003)	2.5 (0.003)	0.65 (0.003)
Metals									
LEAD	mg/kg	2240[C]	450[B], 2240[C]	74.0 (0.0051)	94.3 (0.0051)	***1710***[B] (0.0051)	157 (0.0051)	***892***[B] (0.0051)	110 (0.0051)

Historical Soil Analytical Results Summary (0-2 feet)
AOI 6 Site Characterization Report
Marcus Hook Industrial Complex

Notes:

DC MSC-PA	PADEP, August 2016 Direct Contact Medium Specific Concentrations.
A	Medium-Specific Concentrations (MSCs) for Organic/Inorganic Regulated Substances in Soil - Direct Contact - Non-Residential Surface Soil (0-2 ft). Lead value is the site-specific standard.
SHS MSC-PA	PADEP, August 2016 Statewide Health Standards, Medium Specific Concentrations.
B	PADEP Non-Residential Statewide Health Standards (0-2 ft bgs).
SSS	Site Specific Standard.
C	PADEP Non-Residential Site Specific Standard (0-2 ft bgs).
6.5 [A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.50)	Laboratory reporting limit was greater than the applicable standard.
ND (0.005) (0.0005)	Analyte was not detected at a concentration greater than the laboratory reporting limit. The first value in parenthesis is the reporting limit. The method detection limit is shown in the second set of parenthesis.
0.038 (0.003)	The first value is the detected concentration. The second value is the method detection limit.
-	Parameter not analyzed / not available.
J	Indicates an estimated value
ft bgs	feet below ground surface.
mg/kg	milligrams per kilogram.

Analytical data for this table obtained from Stantec database in 2016/2017.

Table 4a

2016 Soil Analytical Results Summary (>2 feet)
AOI 6 Site Characterization Report
Marcus Hook Industrial Complex

Sample Location				AOI6-BH-16-005	AOI6-BH-16-006	AOI6-BH-16-007
Sample Date				22-Apr-16	22-Apr-16	22-Apr-16
Sample ID				BH-16-005-10-11-SOIL	BH-16-006-10-12-SOIL	BH-16-007-6-7.5-SOIL
Sample Depth				10 - 11 ft	10 - 12 ft	6 - 7.5 ft
Sampling Company				GHD	GHD	GHD
Laboratory Sample ID		A	B	8347276	8347278	8347280
	Units	DC MSC-PA	SHS MSC-PA			
Volatile Organic Compounds						
BENZENE	mg/kg	330[A]	0.5[B]	*ND (16)* (0.0005)	*ND (19)* (0.0005)	ND (0.007) (0.0005)
1,2-DIBROMOETHANE (EDB)	mg/kg	4.3[A]	0.005[B]	*ND (16)* (0.001)	*ND (19)* (0.001)	*ND (0.007)* (0.001)
1,2-DICHLOROETHANE (EDC)	mg/kg	98[A]	0.5[B]	*ND (16)* (0.001)	*ND (19)* (0.001)	ND (0.007) (0.001)
ETHYLBENZENE	mg/kg	1000[A]	70[B]	ND (16) (0.001)	ND (19) (0.001)	ND (0.007) (0.001)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000[A]	2500[B]	11 J (0.001)	ND (19) (0.001)	0.004 J (0.001)
METHYL TERTIARY BUTYL ETHER	mg/kg	9900[A]	2[B]	*ND (16)* (0.0005)	*ND (19)* (0.0005)	ND (0.007) (0.0005)
TOLUENE	mg/kg	10000[A]	100[B]	ND (16) (0.001)	ND (19) (0.001)	ND (0.007) (0.001)
1,2,4-TRIMETHYLBENZENE	mg/kg	640[A]	35[B]	ND (16) (0.001)	ND (19) (0.001)	0.006 J (0.001)
1,3,5-TRIMETHYLBENZENE	mg/kg	10000[A]	210[B]	ND (16) (0.001)	ND (19) (0.001)	ND (0.007) (0.001)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	9100[A]	1000[B]	ND (16) (0.001)	ND (19) (0.001)	ND (0.007) (0.001)
Semi-Volatile Organic Compounds						
ANTHRACENE	mg/kg	190000[A]	350[B]	5.0 (0.003)	5.6 (0.003)	0.52 (0.003)
BENZO(A)ANTHRACENE	mg/kg	190000[A]	430[B]	19 (0.003)	14 (0.003)	0.88 (0.003)
BENZO(A)PYRENE	mg/kg	190000[A]	46[B]	9.9 (0.003)	11 (0.003)	0.43 (0.003)
BENZO(B)FLUORANTHENE	mg/kg	190000[A]	170[B]	10 (0.003)	8.5 (0.003)	0.48 (0.003)
BENZO(G,H,I)PERYLENE	mg/kg	190000[A]	180[B]	3.9 (0.003)	3.8 (0.003)	0.37 (0.003)
CHRYSENE	mg/kg	190000[A]	230[B]	38 (0.003)	33 (0.003)	1.5 (0.003)
FLUORENE	mg/kg	190000[A]	3800[B]	3.3 (0.003)	3.6 (0.003)	1.2 (0.003)
NAPHTHALENE	mg/kg	190000[A]	25[B]	3.1 (0.003)	1.0 (0.003)	1.5 (0.003)
PHENANTHRENE	mg/kg	190000[A]	10000[B]	28 (0.003)	47 (0.003)	3.4 (0.003)
PYRENE	mg/kg	190000[A]	2200[B]	25 (0.003)	40 (0.003)	1.6 (0.003)
Metals						
LEAD	mg/kg	190000[A]	450[B]	325 (0.510)	***616***[B] (0.510)	100 (0.510)

2016 Soil Analytical Results Summary (>2 feet)
AOI 6 Site Characterization Report
Marcus Hook Industrial Complex

Notes:

DC MSC-PA	PADEP, August 2016 Direct Contact Medium Specific Concentrations.
[A]	Medium-Specific Concentrations (MSCs) for Organic/Inorganic Regulated Substances in Soil - Direct Contact - Non-Residential Subsurface Soil (2-15 ft).
SHS MSC-PA	PADEP, August 2016 Statewide Health Standards, Medium Specific Concentrations.
[B]	PADEP Non-Residential Statewide Health Standards (>2 ft bgs).
6.5 [A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.50)	Laboratory reporting limit was greater than the applicable standard.
ND (0.004) (0.0005)	Analyte was not detected at a concentration greater than the laboratory reporting limit. The first value in parenthesis is the reporting limit. The method detection limit is shown in the second set of parenthesis.
0.740 (0.003)	The first value is the detected concentration. The second value is the method detection limit.
-	Parameter not analyzed / not available.
J	Indicates an estimated value.
ft bgs	feet below ground surface.
mg/kg	milligrams per kilogram.

Analytical data for this table obtained from Stantec database in 2016/2017.

Table 4b

Historical Soil Analytical Results Summary (>2 feet)
AOI 6 Site Characterization Report
Marcus Hook Industrial Complex

Sample Location				**MW-304**	**MW-305**	**TP-2**	**TP-6**
Sample Date				**26-Apr-12**	**12-Apr-12**	**9-Jul-12**	**9-Jul-12**
Sample ID				**MW-304@10-12'**	**MW-305@8-9'**	**TP-2_4-4.5**	**TP-6_5-5.5**
Sample Depth				**10 - 12 ft**	**8 - 9 ft**	**4 - 4.5 ft**	**5 - 5.5 ft**
Sampling Company				**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**
Laboratory Sample ID		**A**	**B**	**6635688**	**6617753**	**6714796**	**6714792**
	Units	**DC MSC-PA**	**SHS MSC-PA**				
Volatile Organic Compounds							
BENZENE	mg/kg	330[A]	0.5[B]	ND (0.005) (0.0005)	ND (0.035) (0.0005)	ND (0.48) (0.0005)	ND (0.005) (0.0005)
1,2-DIBROMOETHANE (EDB)	mg/kg	4.3[A]	0.005[B]	ND (0.005) (0.001)	*ND (0.070)* (0.001)	*ND (0.96)* (0.001)	ND (0.005) (0.001)
1,2-DICHLOROETHANE (EDC)	mg/kg	98[A]	0.5[B]	ND (0.005) (0.001)	ND (0.070) (0.001)	*ND (0.96)* (0.001)	ND (0.005) (0.001)
ETHYLBENZENE	mg/kg	1000[A]	70[B]	ND (0.005) (0.001)	ND (0.070) (0.001)	ND (0.96) (0.001)	ND (0.005) (0.001)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000[A]	2500[B]	ND (0.005) (0.001)	ND (0.070) (0.001)	ND (0.96) (0.001)	ND (0.005) (0.001)
METHYL TERTIARY BUTYL ETHER	mg/kg	9900[A]	2[B]	ND (0.005) (0.0005)	ND (0.035) (0.0005)	ND (0.48) (0.0005)	ND (0.005) (0.0005)
NAPHTHALENE	mg/kg	190000[A]	25[B]	-	-	-	-
TOLUENE	mg/kg	10000[A]	100[B]	ND (0.005) (0.001)	ND (0.070) (0.001)	0.99 J (0.001)	ND (0.005) (0.001)
1,2,4-TRIMETHYLBENZENE	mg/kg	640[A]	35[B]	ND (0.005) (0.001)	0.28 J (0.001)	4 J (0.001)	ND (0.005) (0.001)
1,3,5-TRIMETHYLBENZENE	mg/kg	10000[A]	210[B]	ND (0.005) (0.001)	0.10 J (0.001)	1.4 J (0.001)	ND (0.005) (0.001)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	9100[A]	1000[B]	ND (0.005) (0.001)	0.075 J (0.001)	2 J (0.001)	ND (0.005) (0.001)
Semi-Volatile Organic Compounds							
ANTHRACENE	mg/kg	190000[A]	350[B]	0.025 (0.003)	0.25 (0.003)	2.4 J (0.003)	ND (0.022) (0.003)
BENZO(A)ANTHRACENE	mg/kg	190000[A]	430[B]	ND (0.021) (0.003)	0.65 (0.003)	20 (0.003)	ND (0.022) (0.003)
BENZO(A)PYRENE	mg/kg	190000[A]	46[B]	ND (0.021) (0.003)	0.73 (0.003)	29 (0.003)	ND (0.022) (0.003)
BENZO(B)FLUORANTHENE	mg/kg	190000[A]	170[B]	ND (0.021) (0.003)	0.67 (0.003)	27 (0.003)	ND (0.022) (0.003)
BENZO(G,H,I)PERYLENE	mg/kg	190000[A]	180[B]	ND (0.021) (0.003)	0.59 (0.003)	14 (0.003)	ND (0.022) (0.003)
CHRYSENE	mg/kg	190000[A]	230[B]	ND (0.021) (0.003)	0.87 (0.003)	63 (0.003)	ND (0.022) (0.003)
FLUORENE	mg/kg	190000[A]	3800[B]	0.068 (0.003)	0.31 (0.003)	2.4 J (0.003)	ND (0.022) (0.003)
NAPHTHALENE	mg/kg	190000[A]	25[B]	ND (0.021) (0.003)	0.044 J (0.003)	3.8 J (0.003)	ND (0.022) (0.003)
PHENANTHRENE	mg/kg	190000[A]	10000[B]	0.073 (0.003)	0.14 J (0.003)	18 (0.003)	ND (0.022) (0.003)
PYRENE	mg/kg	190000[A]	2200[B]	0.041 (0.003)	0.54 (0.003)	37 (0.003)	ND (0.022) (0.003)
Metals							
LEAD	mg/kg	190000[A]	450[B]	10.7 (0.0051)	28.9 (0.0051)	193 (0.0051)	49.0 (0.0051)

Table 4b

Historical Soil Analytical Results Summary (>2 feet)
AOI 6 Site Characterization Report
Marcus Hook Industrial Complex

Notes:

DC MSC-PA	PADEP, August 2016 Direct Contact Medium Specific Concentrations.
[A]	Medium-Specific Concentrations (MSCs) for Organic/Inorganic Regulated Substances in Soil - Direct Contact - Non-Residential Subsurface Soil (2-15 ft).
SHS MSC-PA	PADEP, August 2016 Statewide Health Standards, Medium Specific Concentrations.
[B]	PADEP Non-Residential Statewide Health Standards (>2 ft bgs).
6.5 [A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.50)	Laboratory reporting limit was greater than the applicable standard.
ND (0.020) (0.003)	Analyte was not detected at a concentration greater than the laboratory reporting limit. The first value in parenthesis is the reporting limit. The method detection limit is shown in the second set of parenthesis.
0.740 (0.003)	The first value is the detected concentration. The second value is the method detection limit.
-	Parameter not analyzed / not available.
J	Indicates an estimated value
ft bgs	feet below ground surface.
mg/kg	milligrams per kilogram.

Analytical data for this table obtained from Stantec database in 2016/2017.

Appendices

Appendix A
PNDI Review Documentation

1. PROJECT INFORMATION

Project Name: **MHIC AOI 6**
Date of Review: **9/26/2016 12:25:52 PM**
Project Category: **Hazardous Waste Clean-up, Site Remediation, and Reclamation, Other**
Project Area: **49.21 acres**
County(s): **Delaware**
Township/Municipality(s): **MARCUS HOOK**
ZIP Code: **19061**
Quadrangle Name(s): **MARCUS HOOK**
Watersheds HUC 8: **Lower Delaware**
Watersheds HUC 12: **Oldmans Creek-Delaware River; Repaupo Creek-Delaware River**
Decimal Degrees: **39.810087, -75.419688**
Degrees Minutes Seconds: **39° 48' 36.3134" N, 75° 25' 10.8765" W**

2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
PA Department of Conservation and Natural Resources	No Known Impact	No Further Review Required
PA Fish and Boat Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

Note that regardless of PNDI search results, projects requiring a Chapter 105 DEP individual permit or GP 5, 6, 7, 8, 9 or 11 in certain counties (Adams, Berks, Bucks, Carbon, Chester, Cumberland, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Schuylkill and York) must comply with the bog turtle habitat screening requirements of the PASPGP.

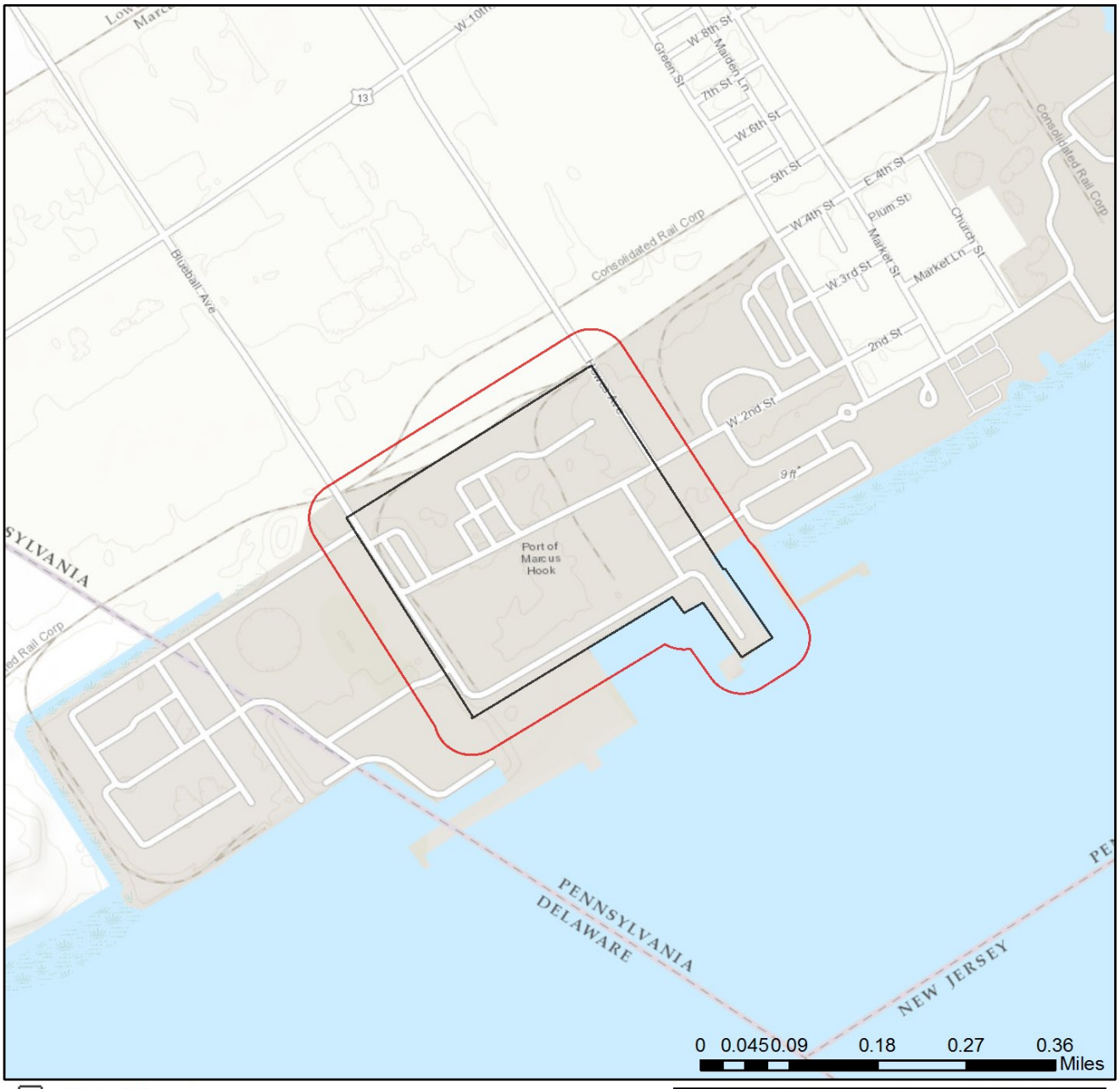
MHIC AOI 6

Project Boundary

Buffered Project Boundary

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA,

MHIC AOI 6



Project Boundary

Buffered Project Boundary

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for two years** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission

RESPONSE:

Further review of this project is necessary to resolve the potential impact(s). Please send project information to this agency for review (see WHAT TO SEND).

PGC Species: (Note: The Pennsylvania Conservation Explorer tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)

Scientific Name	Common Name	Current Status
Pandion haliaetus	Osprey	Threatened

PA Department of Conservation and Natural Resources

RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Fish and Boat Commission

RESPONSE:

Further review of this project is necessary to resolve the potential impact(s). Please send project information to this agency for review (see WHAT TO SEND).

PFBC Species: (Note: The Pennsylvania Conservation Explorer tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)

Scientific Name	Common Name	Current Status
Sensitive Species**		Endangered
Sensitive Species**		Endangered
Sensitive Species**		Threatened

U.S. Fish and Wildlife Service

RESPONSE:

No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq. is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictional agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, upload* or email* the following information to the agency(s). Instructions for uploading project materials can be found here. This option provides the applicant with the convenience of sending project materials to a single location accessible to all three state agencies. Alternatively, applicants may email or mail their project materials (see AGENCY CONTACT INFORMATION).
***Note:** U.S.Fish and Wildlife Service requires applicants to mail project materials to the USFWS PA field office (see AGENCY CONTACT INFORMATION). USFWS will not accept project materials submitted electronically (by upload or email).

Check-list of Minimum Materials to be submitted:
____Project narrative with a description of the overall project, the work to be performed, current physical characteristics of the site and acreage to be impacted.
____A map with the project boundary and/or a basic site plan(particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)
In addition to the materials listed above, USFWS REQUIRES the following
____**SIGNED** copy of a Final Project Environmental Review Receipt

The inclusion of the following information may expedite the review process.
____Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)
____Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams.

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. Two review options are available to permit applicants for handling PNDI coordination in conjunction with DEP's permit review process involving either T&E Species or species of special concern. Under sequential review, the permit applicant performs a PNDI screening and completes all coordination with the appropriate jurisdictional agencies prior to submitting the permit application. The applicant will include with its application, both a PNDI receipt and/or a clearance letter from the jurisdictional agency if the PNDI Receipt shows a Potential Impact to a species or the applicant chooses to obtain letters directly from the jurisdictional agencies. Under concurrent review, DEP, where feasible, will allow technical review of the permit to occur concurrently with the T&E species consultation with the jurisdictional agency. The applicant must still supply a copy of the PNDI Receipt with its permit application. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. The applicant and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at https://conservationexplorer.dcnr.pa.gov/content/resources.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a preliminary screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552
Email: RA-HeritageReview@pa.gov
Fax:(717) 772-0271

U.S. Fish and Wildlife Service
Pennsylvania Field Office
Endangered Species Section
110 Radnor Rd; Suite 101
State College, PA 16801
NO Faxes Please

PA Fish and Boat Commission
Division of Environmental Services
450 Robinson Lane, Bellefonte, PA 16823
Email: RA-FBPACENOTIFY@pa.gov

PA Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA 17110-9797
Email: RA-PGC_PNDI@pa.gov
NO Faxes Please

7. PROJECT CONTACT INFORMATION

Name: Christine Miller
Company/Business Name: GHD
Address: 410 Eagleview Blvd, Ste 110
City, State, Zip: Exton PA 19341
Phone:(610) 646-7470 Fax:(610) 321-2763
Email: Christine.miller@ghd.com

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

Christine Miller — 3/7/17

applicant/project proponent signature — date

1. PROJECT INFORMATION

Project Name: **MHIC AOI 6**
Date of Review: **3/23/2017 02:11:06 PM**
Project Category: **Hazardous Waste Clean-up, Site Remediation, and Reclamation, Other**
Project Area: **49.21 acres**
County(s): **Delaware**
Township/Municipality(s): **MARCUS HOOK**
ZIP Code: **19061**
Quadrangle Name(s): **MARCUS HOOK**
Watersheds HUC 8: **Lower Delaware**
Watersheds HUC 12: **Oldmans Creek-Delaware River; Repaupo Creek-Delaware River**
Decimal Degrees: **39.810087, -75.419688**
Degrees Minutes Seconds: **39° 48' 36.3134" N, 75° 25' 10.8765" W**

2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	No Known Impact	No Further Review Required
PA Department of Conservation and Natural Resources	No Known Impact	No Further Review Required
PA Fish and Boat Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

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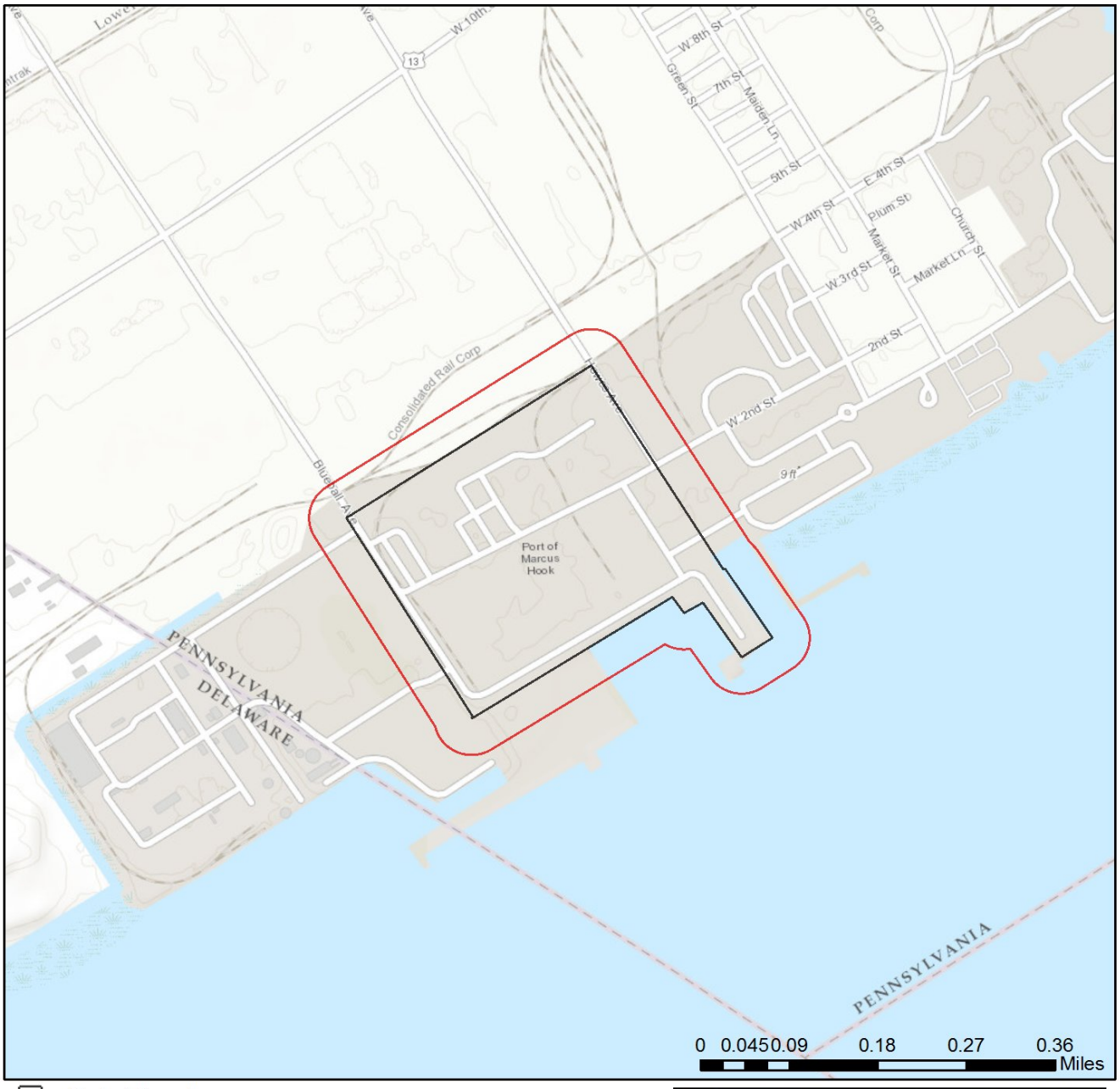
MHIC AOI 6

Project Boundary

Buffered Project Boundary

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user

MHIC AOI 6



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PA Game Commission

RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Department of Conservation and Natural Resources

RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Fish and Boat Commission

RESPONSE:

Further review of this project is necessary to resolve the potential impact(s). Please send project information to this agency for review (see WHAT TO SEND).

PFBC Species: (Note: The Pennsylvania Conservation Explorer tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)

Scientific Name	Common Name	Current Status
Sensitive Species**		Endangered
Sensitive Species**		Endangered
Sensitive Species**		Threatened

U.S. Fish and Wildlife Service

RESPONSE:

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For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

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Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552
Email: RA-HeritageReview@pa.gov
Fax:(717) 772-0271

U.S. Fish and Wildlife Service
Pennsylvania Field Office
Endangered Species Section
110 Radnor Rd; Suite 101
State College, PA 16801
NO Faxes Please

PA Fish and Boat Commission
Division of Environmental Services
450 Robinson Lane, Bellefonte, PA 16823
Email: RA-FBPACENOTIFY@pa.gov

PA Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA 17110-9797
Email: RA-PGC_PNDI@pa.gov
NO Faxes Please

7. PROJECT CONTACT INFORMATION

Name:_____
Company/Business Name:_____
Address:_____
City, State, Zip:_____
Phone:(_____)_____Fax:(_____)_____
Email:_____

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

_____ _____
applicant/project proponent signature date

March 7, 2017 Reference No. 11109679

PA Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue
Harrisburg, PA 17110

Dear Sir/Madam:

Re: PNDI# 613793
Project Review Request
Evergreen Marcus Hook Industrial Complex AOI-6
City of Marcus Hook, Delaware County, Pennsylvania

GHD Services, Inc. (GHD) was retained by Marcus Hook Industrial Complex, a series of Evergreen Resources Group, LLC (Evergreen) to perform delineation of soil and groundwater under Remedial Facility Investigation of Area of Investigation (AOI) 6 (Study Area) at the Marcus Hook Industrial Complex located in the City of Marcus Hook, Delaware County, Pennsylvania. The location of the Study Area is shown on a portion of the Marcus Hook, PA USGS topographic quadrangle map provided as Figure 1. An aerial photograph showing the Study Area and adjoining land uses is provided as Figure 2.

A Pennsylvania Natural Diversity Inventory (PNDI) database search (Receipt No.613793) conducted for the Study Area identified a potential conflict with one (1) threatened species, the Osprey (*Pandion haliaetus*), under the jurisdiction of the Pennsylvania Game Commission (PGC). A copy of the PNDI search receipt is provided as Attachment A.

The Study Area consists of historically disturbed industrial lands associated with oil refining processes. The Delaware River borders the Study Area to the south and is bulkheaded along two thirds of the length of AOI-6 Study Area.

The Study Area is currently undergoing active site re-development activities by others. No remediation activities are proposed at this time. We are requesting your project review.

If you have any questions or require additional information, please contact me at (610) 646-7470 or Christine.miller@ghd.com.

GHD Services Inc.
410 Eagleview Boulevard Suite 110 Exton Pennsylvania 19341 USA
T 610 321 1800 **F** 610 321 2763 **W** www.ghd.com

Sincerely,

GHD

Christine J. Miller

CM/cm/1

Encl.

cc: Tiffani Doerr - Evergreen Resources Group, LLC
Jim Oppenheim - Evergreen Resources Group, LLC
David Steele - GHD Services, Inc.

Source: ESRI Topographic Basemap, Accessed 2017

0 100 200 300
Feet

Coordinate System:
NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

EVERGREEN RESOURCES MANAGEMENT

11109679-03
Mar 7, 2017

AOI 6 MARCUS HOOK INDUSTRIAL COMPLEX

FIGURE 1

GIS File: Q:\GIS\PROJECTS\11109000s\11109679\Layouts\PNDI001\11109679-03(PNDI001)GIS-OT001.mxd

Source: Aerial: August 29, 2016 © 2016 - TerraServer®

0 100 200 300
Feet

Coordinate System:
NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

EVERGREEN RESOURCES MANAGEMENT

11109679-03
Feb 28, 2017

AOI 6 MARCUS HOOK INDUSTRIAL COMPLEX

FIGURE 2

GIS File: Q:\GIS\PROJECTS\11109000s\11109679\Layouts\PNDI001\11109679-03(PNDI001)GIS-OT002.mxd

March 7, 2017 Reference No. 11109679

Mr. Christopher Urban
Chief, Natural Diversity Section
Pennsylvania Fish & Boat Commission
450 Robinson Lane
Bellefonte, PA 16823-9620

Dear Mr. Urban:

Re: PNDI# 613793
Project Review Request
Evergreen Marcus Hook Industrial Complex AOI-6
City of Marcus Hook, Delaware County, Pennsylvania

GHD Services, Inc. (GHD) was retained by Marcus Hook Industrial Complex, a series of Evergreen Resources Group, LLC (Evergreen) to perform delineation of soil and groundwater under Remedial Facility Investigation of Area of Investigation (AOI) 6 (Study Area) at the Marcus Hook Industrial Complex located in the City of Marcus Hook, Delaware County, Pennsylvania. The location of the Study Area is shown on a portion of the Marcus Hook, PA USGS topographic quadrangle map provided as Figure 1. An aerial photograph showing the Study Area and adjoining land uses is provided as Figure 2.

A Pennsylvania Natural Diversity Inventory (PNDI) database search (Receipt No.613793) conducted for the Study Area identified a potential conflict with two (2) endangered species and one (1) threatened species under the jurisdiction of the Pennsylvania Fish and Boat Commission (PFBC). A copy of the PNDI search receipt is provided as Attachment A.

The Study Area consists of historically disturbed industrial lands associated with oil refining processes. The Delaware River borders the Study Area to the south and is bulkheaded along two thirds of the length of AOI-6 Study Area. There do not appear to be any wetlands or water bodies within the Study Area.

The Study Area is currently undergoing active site re-development activities by others. No remediation activities are proposed at this time. We are requesting your project review.

If you have any questions or require additional information, please contact me at (610) 646-7470 or Christine.miller@ghd.com.

GHD Services Inc.
410 Eagleview Boulevard Suite 110 Exton Pennsylvania 19341 USA
T 610 321 1800 **F** 610 321 2763 **W** www.ghd.com

Sincerely,

GHD

Christine J. Miller

CM/cm/1

Encl.

cc: Tiffani Doerr - Evergreen Resources Group, LLC
Jim Oppenheim - Evergreen Resources Group, LLC
David Steele - GHD Services, Inc.

Source: ESRI Topographic Basemap, Accessed 2017

0 100 200 300
Feet

Coordinate System:
NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

EVERGREEN RESOURCES MANAGEMENT

11109679-03
Mar 7, 2017

AOI 6 MARCUS HOOK INDUSTRIAL COMPLEX

FIGURE 1

GIS File: Q:\GIS\PROJECTS\11109000s\11109679\Layouts\PNDI001\11109679-03(PNDI001)GIS-OT001.mxd

Source: Aerial: August 29, 2016 © 2016 - TerraServer®

0 100 200 300
Feet

Coordinate System:
NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

EVERGREEN RESOURCES MANAGEMENT

11109679-03
Feb 28, 2017

AOI 6 MARCUS HOOK INDUSTRIAL COMPLEX

FIGURE 2

GIS File: Q:\GIS\PROJECTS\11109000s\11109679\Layouts\PNDI001\11109679-03(PNDI001)GIS-OT002.mxd

Pennsylvania Fish & Boat Commission
established 1866

Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823
814-359-5237

April 5, 2017

IN REPLY REFER TO
SIR# 47503

GHD
Christine Miller
410 Eagleview Blvd.
Exton, Pennsylvania 19341

RE: Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species
PNDI Search No. 613793_1
MHIC AOI 6
DELAWARE County: Marcus Hook Borough

Dear Ms. Miller:

This responds to your inquiry about a Pennsylvania Natural Diversity Inventory (PNDI) Internet Database search "potential conflict" or a threatened and endangered species impact review. These projects are screened for potential conflicts with rare, candidate, threatened or endangered species under Pennsylvania Fish & Boat Commission jurisdiction (fish, reptiles, amphibians, aquatic invertebrates only) using the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files. These species of special concern are listed under the Endangered Species Act of 1973, the Wild Resource Conservation Act, and the Pennsylvania Fish & Boat Code (Chapter 75), or the Wildlife Code.

Based on records maintained in the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files, the following rare or protected species are known from the vicinity of the project site:

Common Name (Scientific Name, PA Status)
Atlantic Sturgeon (*Acipenser oxyrinchus*, Endangered)
Shortnose Sturgeon (*Acipenser brevirostrum*, Endangered)
Eastern Redbelly Turtle (*Pseudemys rubriventris*, Threatened)

There does not appear to be habitat for any of these species of concern within the project area, with the exception of the Delaware River itself.

This response represents the most up-to-date summary of the PNDI data and our files and is valid for two (2) years from the date of this letter. An absence of recorded species information does not necessarily imply species absence. Our data files and the PNDI system are continuously being updated with species occurrence information.

Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered, and consultation shall be re-initiated.

If you have any questions regarding this review, please contact Kathy Gipe at 814-359-5186 and refer to the SIR # 47503. Thank you for your cooperation and attention to this important matter of species conservation and habitat protection.

Sincerely,

Christopher A. Urban, Chief
Natural Diversity Section

CAU/KDG/dn

U.S. Fish and Wildlife Service
National Wetlands Inventory

MHIC AOI 6

January 5, 2018

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

R1UBV = Riverine, tidal, unconsolidated bottom, permanently flooded (tidal)

Appendix B
Historic Tank Documents

NOTIFICATION OF REPORTABLE RELEASE *(Owners and Operators)*
NOTIFICATION OF CONTAMINATION *(Certified Installers and Inspectors)*

NOTIFICATION OF REPORTABLE RELEASE *(Owners and Operators)*

On August 21, 1993, the Storage Tank Program's Corrective Action Process (CAP) regulations became effective. These regulations establish release reporting requirements for owners and operators of storage tanks and storage tank facilities.

Subsection 245.305(a) of the regulations requires owners or operators to notify the appropriate regional office of the Department as soon as practicable, but no later than 2 hours, after the confirmation of a reportable release.

Subsection 245.305(d) requires owners or operators to provide written notification to the appropriate regional office and to the local municipality, within 15 days of the notice required by Subsection 245.305(a). This form may be used to comply with Subsection 245.305(d).

OWNERS AND OPERATORS (O/O)

PLEASE COMPLETE SECTIONS I, II, IIIA, IIIB, IV, V, VII and VIII.

NOTIFICATION OF CONTAMINATION *(Certified Installers and Inspectors)*

On September 21, 1991, the Storage Tank Program's Certification regulations became effective. These regulations establish standards of performance for certified installers and inspectors of storage tanks and storage tank facilities.

Subsection 245.132(a)(4) of the regulations requires certified installers and inspectors to report to the Department a release of a regulated substance or confirmed or suspected contamination of soil, surface or groundwater from regulated substances observed while performing services as a certified installer or inspector.

This form may be used to comply with Subsection 245.132(a)(4). The Department expects submission of the form within 48 hours of observing suspected or confirmed contamination. Where there is a reportable release, the form may be submitted jointly by the owner, operator, certified installer and certified inspector. In this instance, the form must be received by the appropriate regional office within 15 days of the notice required by Subsection 245.305(a).

CERTIFIED INSTALLERS AND INSPECTORS (I/I)

PLEASE COMPLETE SECTIONS I, II, IIIA, IIIC, VI, VII and VIII.

INSTRUCTIONS

I. **FACILITY INFORMATION** - Record the name, I D number and physical location (not P.O. Box) of the facility at which a reportable release has been confirmed or at which suspected or confirmed contamination has been observed. Include the name and phone number of a person to contact at the facility

II. **OWNER INFORMATION** - Record the name, business address and phone number of the owner of the facility identified in Section I

III. **REGULATED SUBSTANCE INFORMATION** - Indicate to the best of your knowledge: A) the type of product or products involved, B) the quantity of product or products released; and C) whether the contamination is suspected or confirmed.

IV. **REPORTABLE RELEASE INFORMATION** - Record the date of confirmation of the reportable release, e.g., "08/21/93"; the date and regional office notified; and the date the local municipality (provide name of municipality) was sent a copy of this form. Indicate to the best of your knowledge the extent of contamination resulting from the release of the regulated substance.

V. **INTERIM REMEDIAL ACTIONS** - Indicate the interim remedial actions planned, initiated or completed.

VI. **SUSPECTED/CONFIRMED CONTAMINATION INFORMATION** - Record the date of observation of the suspected or confirmed contamination, e.g., "01/01/94". Indicate to the best of your knowledge the indications of a suspected release or extent of confirmed contamination resulting from the release of the regulated substance.

VII. **ADDITIONAL INFORMATION** - Provide any additional, relevant, available information concerning the reportable release or suspected or confirmed contamination. Include in this section a brief description of the activity that was being conducted when the reportable release was confirmed by the owner or operator or when the suspected/confirmed contamination was observed by the certified installer or inspector, e.g., during a(n) installation, repair or upgrade, removal from service or routine inspection.

VIII. **CERTIFICATION** - Please print your name, and provide your signature and date of signature. If a certified installer/inspector, provide certification number and company certification number.

PLEASE SEND COMPLETED ORIGINAL FORM TO:

PA Department of Environmental Resources
Environmental Cleanup Program
Storage Tank Section
(and the appropriate address below, depending on where the FACILITY is located)

ECP UST

Southeast Region	Northeast Region	Southcentral Region	Northcentral Region	Southwest Region	Northwest Region
Lee Park, Suite 6010 555 North Lane Conshohocken, PA 19428 FAX 610-832-6259/6260	Cross Valley Centre 667 North River Street Plains, PA 18705 FAX: 717-826-5448	One Ararat Boulevard Harrisburg, PA 17110 FAX: 717-540-7492	200 Pine Street Williamsport, PA 17701 FAX: 717-327-3565	400 Waterfront Drive Pittsburgh, PA 15222 FAX. 412-442-4194	1012 Water Street Meadville, PA 16335 FAX: 814-332-6831
Counties Bucks, Chester, Delaware, Montgomery, Philadelphia	Counties Carbon, Lackawanna, Lehigh, Luzerne, Monroe, Northampton, Pike, Schuylkill, Susquehanna, Wayne, Wyoming	Counties Adams, Bedford, Berks, Blair, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lancaster, Lebanon, Mifflin, Perry, York	Counties Bradford, Cameron, Centre, Clinton, Clearfield, Columbia, Lycoming, Montour, Northumberland, Potter, Snyder, Sullivan, Tioga, Union	Counties Allegheny, Armstrong, Beaver, Cambria, Fayette, Greene, Indiana, Somerset, Washington, Westmoreland	Counties Butler, Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Venango, Warren

I. FACILITY INFORMATION (Both O/O and I/I)

Facility Name: Marcus Hook Refinery
Facility I.D. Number: 23-14224
Street Address (P.O. Box not acceptable): Delaware Avenue & Green Streets
City: Marcus Hook,
State: PA
Zip Code: 19061
County: Delaware
Municipality: Marcus Hook
Contact Person: David J. Kistler
Phone Number: (610) 859-1178

II. OWNER INFORMATION (Both O/O and I/I)

Owner Name: Sun Company, Inc. (R&M)
Address: P.O. Box 426
City: Marcus Hook,
State: PA
Zip Code: 19061
Phone Number: (610) 859 1178

III. REGULATED SUBSTANCE INFORMATION

A. Type of Product(s) Involved (Mark All That Apply ☒): Both O/O and I/I		B. Quantity (Gallons) of Product(s) Released: O/O Only	C. Contamination Suspected [S] or Confirmed [C]: I/I Only	
Leaded Gasoline	☐		[S]	[C]
Unleaded Gasoline	☐		[S]	[C]
Aviation Gasoline	☐		[S]	[C]
Kerosene	☐		[S]	[C]
Jet Fuel	☐		[S]	[C]
Diesel Fuel	☐		[S]	[C]
New Motor Oil	☐		[S]	[C]
Used Motor Oil	☐		[S]	[C]
Fuel Oil No. 1	☐		[S]	[C]
Fuel Oil No. 2	☐		[S]	[C]
Fuel Oil No. 4	☐		[S]	[C]
Fuel Oil No. 5	☐		[S]	[C]
Fuel Oil No. 6	☐		[S]	[C]
Other (Specify) Sundex 8125	☒	4 2 , 0 0 0	[S]	[C]
Unknown Lube. Oil	☐		[S]	[C]

IV. REPORTABLE RELEASE INFORMATION (O/O Only)

Date Reportable Release was Confirmed: 6 / 3 / 95 (m / d / y)

Date Owner/Operator Verbally Notified Appropriate Regional Office of Reportable Release and Office Notified:

Date 6 / 3 / 95 (m / d / y) Office PaDER Southeast

Date Owner/Operator Sent Copy of this Written Notification to Local Municipality and Name of Municipality Notified:

Date 6 / 15 / 95 (m / d / y) Municipality Borough of Marcus Hook

Environmental Impacts (Mark All That Apply ☒):

Soil	☒
Sediment	☐
Surface Water	☐
Ground Water	☐
Water Supplies	☐

V. INTERIM REMEDIAL ACTIONS (O/O Only)

(Mark All That Apply ☒):

	Planned	Initiated	Completed	Not Applicable
Regulated Substance Removed from Storage Tanks	☐	☐	☐	☒
Fire, Explosion and Safety Hazards Mitigated	☐	☐	☒	☐
Contaminated Soil Excavated	☐	☒	☐	☐
Free Product Recovered	☐	☐	☒	☐
Temporary Water Supplies Provided	☐	☐	☐	☒
Other (Specify) _____	☐	☐	☐	☒

VI. SUSPECTED / CONFIRMED CONTAMINATION INFORMATION (I/I Only)

Date of Observation of Suspected/Confirmed Contamination: ___ / ___ / ___ (m / d / y)

Indication of Suspected Contamination (Mark All That Apply ☒):

Unusual Level of Vapors	☐
Erratic Behavior of Product Dispensing Equipment	☐
Release Detection Results Indicate a Release	☐
Discovery of Holes in the Storage Tank	☐
Other (Specify) _____	☐

Extent of Confirmed Contamination (Mark All That Apply ☒):

Product Stained or Product Saturated Soil or Backfill	☐
Ponded Product	☐
Free Product or Sheen on Ponded Water	☐
Free Product or Sheen on the Ground Water Surface	☐
Free Product or Sheen on Surface Water	☐
Other (Specify) _____	☐

ER-BWQ-32: 2/94

VII. ADDITIONAL INFORMATION (Both O/O and I/I)

Include a brief description of the activity that was being conducted when the reportable release was confirmed by the owner or operator or when the suspected/confirmed contamination was observed by the certified installer or inspector, e g , during a(n) installation, repair or upgrade, removal from service or routine inspection.

At approximately 5:00 PM on June 3, 1995, tank 426A was discovered overflowing Sundex 8125, a lube oil, into a secondary containment area. Upon discovery of the overflow, Sun personnel immediately shut off the pump that was transferring into the tank, thereby stopping the overflow. All free product was recovered and reprocessed at the refinery. Any contaminated soil generated as a result of the overflow will be scraped up and sent to a landfill for proper disposal.

The tank overfill was due to a fill valve that was inadvertently left open and a faulty high-high level alarm.

VIII. CERTIFICATION (Both O/O and I/I)

I, David J. Kistler (Print Name), hereby certify, under penalty of law as provided in 18 Pa C S A §4904(relating to unsworn falsification to authorities) that I am the owner or operator of the above referenced storage tank facility and that the information provided by me in this notification is true, accurate and complete to the best of my knowledge and belief

David J. Kistler — Signature of Owner or Operator

6/14/95 — Date

I, _____ (Print Name), hereby certify, under penalty of law as provided in 18 Pa C S A §4904 (relating to unsworn falsification to authorities) that I am the certified installer who performed tank handling activities at the above referenced storage tank facility and that the information provided by me in this notification is true, accurate and complete to the best of my knowledge and belief

_____ Signature of Certified Installer

_____ Date

_____ Installer Certification Number

_____ Company Certification Number

I, _____ (Print Name), hereby certify, under penalty of law as provided in 18 Pa C S A §4904 (relating to unsworn falsification to authorities) that I am the certified inspector who performed inspection activities at the above referenced storage tank facility and that the information provided by me in this notification is true, accurate and complete to the best of my knowledge and belief

_____ Signature of Certified Inspector

_____ Date

_____ Inspector Certification Number

_____ Company Certification Number

Appendix C
Quality Assurance/Quality Control Plan and Field Procedures Manual

Quality Assurance/Quality Control Plan

Marcus Hook Industrial Complex and Philadelphia Energy Solutions (PES) – Philadelphia Refinery

Evergreen

GHD

410 Eagleview Boulevard, Suite 110 Exton Pennsylvania 19341 United States

11102641 | Report No 1 | April 4, 2016

Table of Contents

1. Introduction

This Quality Assurance/Quality Control (QA/QC) Plan outlines the procedures developed to ensure the collection and analysis of quality data for the completion of investigations completed under the United States Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA) program, Pennsylvania Department of Environmental Protection (PADEP) Act 2 program and Pennsylvania and Delaware's Tank programs at the Marcus Hook Industrial Complex (MHIC) and the Philadelphia Energy Solutions – Philadelphia Refinery (PES Refinery). This document shall be used in conjunction with the Site-Specific Work Plans and Standard Operating Procedures (SOPs) prepared for each site.

The QA/QC Plan is a planning document that provides a "blueprint" for obtaining the type and quality of data needed to support environmental decision making. The QA/QC Plan integrates relevant technical and quality aspects of a project and documents quality assurance and quality control.

2. Quality Control Requirements

The field and laboratory QC requirements for the monitoring activities are discussed in the following subsections. Specific QC checks and acceptance criteria are provided in the referenced analytical methods.

2.1 Field Sampling Quality Control

Field QC requirements include analyzing reference standards for instrument calibration and for routine calibration checks. Field QC samples for this project include, field duplicate samples to assess the overall precision of the sampling and analysis event, equipment rinse blanks to ensure proper cleaning of equipment is conducted between samples to avoid potential cross-contamination, and trip blank samples to monitor cross-contamination of water samples by VOCs. The frequency of collection of these field QC samples is summarized in the Site Specific Field Activities and SOPs, to reflect that a duplicate will be collected 1 in 20 samples and a trip blank will be collected per every sample shipment (cooler).

2.2 Analytical Quality Control

The laboratory QC requirements for the analyses include analyzing method blanks, instrument performance checks, initial calibration standards, calibration verification standards, internal standards, surrogate compound spikes, interference check samples, serial dilution samples, MS/MSD samples, and LCSs. The acceptance criteria for MS/MSD, LCSs, and surrogate compounds will be generated by the laboratory and included in the laboratory reports.

3. Data Verification/Validation and Usability

All field and laboratory data will be reviewed, verified, and/or validated. These terms are defined as follows:

- Data review is the in-house examination to ensure that the data have been recorded, transmitted, and processed correctly.
- Data verification is the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications.
- Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond method, procedure, or contractual compliance (i.e., data verification) to determine the quality of a specific data set relative to the end use.

Field data and logbooks may be reviewed to ensure that the requirements of the sampling program, including the number of samples and locations, sampling, and sample handling procedures, were fulfilled.

Data verification/validation and usability assessments will be performed to ensure that the data are scientifically defensible, properly documented, of known quality, and meet the project objectives are described in the following sections.

3.1 Laboratory Data Review, Verification, and Validation Requirements

Data review, verification and validation of the analytical data will be performed by each Consultant completing the field activities. The evaluation and action criteria specified in this document will be used for validating the data. Qualifiers assigned to the data will be consistent with the data qualifiers specified in the validation guideline.

Stage 1 Verification and Validation Checks

One hundred percent of the sample results will go through a Stage 1 validation (verification). As part of the data management process, each consultant will complete verification based on the Superfund Guidance for Labeling Externally Validated Laboratory Analytical Data (http://www.epa.gov/superfund/policy/pdfs/EPA-540-R-08-005.pdf). Data verification will consist of the following items based on the guidance stated.

Stage 1 validation of the laboratory analytical data package consists of verification and validation checks for the compliance of sample receipt conditions, sample characteristics (e.g., percent moisture), and analytical results (with associated information). It is recommended that the following minimum baseline checks (as relevant) be performed on the laboratory analytical data package received for a Stage 1 validation label:

1. Documentation identifies the laboratory receiving and conducting analyses, and includes documentation for all samples submitted by the project or requester for analyses.
2. Requested analytical methods were performed and the analysis dates are present.

3. Requested target analyte results are reported along with the original laboratory data qualifiers and data qualifier definitions for each reported result (and the uncertainty of each result and clear indication of the type of uncertainty reported if required).
4. Requested target analyte result units are reported (along with their associated uncertainty units if required).
5. Requested reporting limits for all samples are present and results at and below the requested (required) reporting limits are clearly identified (including sample detection limits if required).
6. Sampling dates (including times if needed), date and time of laboratory receipt of samples, and sample conditions upon receipt at the laboratory (including preservation, pH and temperature) are documented.
7. Sample results are evaluated by comparing sample conditions upon receipt at the laboratory (e.g., preservation checks) and sample characteristics (e.g., percent moisture) to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

Stage 2 Verification and Validation Checks

A minimum of 10 percent of the samples will go through a Stage 2 validation. When a laboratory work order is selected, the entire work order will undergo Stage 2 validation. A minimum of 10 percent of the samples will be flagged for VUA. Laboratory work orders or sample delivery groups (SDGs) that are selected for VUA will undergo validation based on the Superfund Program's National Functional Guidelines.

The selection of samples that will undergo VUA process is designed to meet the needs of the site investigation, characterization, remediation, and closure programs, such as tank closures. Sampling that falls outside these programs will not undergo the VUA process. This includes samples that are collected for permit compliance, such as RCRA and effluent wastewater, as well as product samples, onsite soil reuse samples, and waste characterization samples.

Ten percent of samples will be selected based on the following hierarchy:

1. Sample package that will be selected will contain a field duplicate sample.
2. Sample package will be selected at random.

Samples that are collected in the field will provide the best information for completing the VUA reports. The hierarchy is designed to provide the most useful information regarding sample analysis integrity. Therefore, field duplicate samples have been assigned the highest priority. However, field duplicate samples will only be prepared for groundwater samples, not for soil sampling events. If there are insufficient field duplicate samples to meet the 10 percent goal, samples with field blanks will be selected. Sample selection will be a subset of samples collected for a characterization or closure events and will be calculated by taking 10 percent of the number of samples collected. For program efficiency, entire SDGs will be selected for submission in the VUA process. Individual samples should not be selected and processed unless there is an overriding reason to do so. The exception to this scenario will be Aquaterra, where the consultant company working with Aquaterra will validate the samples collected by them.

Stage 2 data validation includes a review of the following QC data deliverables:

1. Technical Holding Times
2. Method Blanks
3. Surrogate Spikes
4. MS/MSD Results
5. LCS Samples
6. Field Duplicates
7. Trip and Equipment Blank Samples

Stage 4 Verification and Validation Checks

Additional data validation may be completed for selected sites and/or sampling events, up to EPA Level 4 data review, which includes all of the elements of a Stage 2 Validation and

1. Evaluation of instrument performance checks (GC/MS)
2. Initial and continuing calibration checks (organic and inorganic analyses)
3. Review of internal standards (GC/MS)
4. Instrument blanks (inorganics)
5. Interference check samples (metals)
6. Recalculations of sample results and reporting limits.

3.2 Groundwater Sampling Methods

Company specific valid codes will be added to the database. This will allow quick identification of the consultant that has performed the verification and/or VUA. Stantec may append additional codes for data management purposes to the codes provided in dt_result table approval_code field. Valid codes are as follows:

Langan:

- LAN1 – Historical data collected by Langan - Level 1 Validation (Verification)
- LAN-VER – Langan performed verification
- LAN-USB – Langan performed usability

GHD:

- GHD-VER – GHD performed verification
- GHD-USB – GHD performed usability

Stantec:

- STN-VER – Stantec performed verification
- STN-USB – Stantec performed usability

This methodology creates a means for consultants to perform verification and usability on data collected by another consultant.

3.3 Data Updates in the Electronic Data Deliverables

All consultants will request EQuIS 4 file format Electronic Data Deliverables (EDDs) for data management from the analytical laboratories. In order to facilitate the data updates in the database, the following methodology is proposed.

1. The consultant chemist / chemist team will open the .RES file for the EDD that has been selected to be validated for usability. The file can be opened using Excel, Access, Notepad or similar tool. Although, it is a best practice to open the file in a way to preserve the textual nature of the EDD, it is unnecessary to do it in this case.
2. The chemist will use the result_comment field in the .RES file to enter the qualifiers associated with the record and add a semicolon as a delimiter (;) followed by the reason code for the qualification (e.g., U;SUR).
3. The .RES file is to be saved with a .USB extension at the end of the file. This file is to be separate from the original .RES file provided and should not be used to over-write the original .RES file that was sent with the EDD. This will result in the laboratory work order undergoing VUA having five files instead of four for the EDD. For example:
    - 1234.SMP
    - 1234.TST
    - 1234.BCH
    - 1234.RES
    - 1234.RES.USB
4. Stantec will use the fifth file to update the database with the appropriate qualifiers and codes in validator_qualifiers and approval_a through approval_d fields in dt_result table in the database.
5. Stantec will also change the validated y/n field in dt_result table in the database for the particular EDD.

3.4 Validation Qualifiers

The following qualifiers should be used during the validation/usability process. These are based on the NFGs and commonly used qualifiers.

Data Qualifiers and Definitions

U The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

J The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

UJ The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

NJ The analyte has been "tentatively identified" or "presumptively identified" as present and the associated numerical value is the estimated concentration in the sample.

R The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.

B The analyte was detected in the method, field, and/or trip blank.

If additional qualifiers are required, please forward the suggestions to the Stantec PM (Jennifer Menges) or the Stantec Data Management Lead (Andrew Bradley), and they will be added to the list of approved codes.

Reason codes

A list of reason codes are available for validation. If additional codes are required, please forward the suggestions to the Stantec PM (Jennifer Menges) or the Stantec Data Management Lead (Andrew Bradley) for addition to the list of approved codes.

Submitting data, Validation CODES for inclusion in the database

EDDs will be submitted to the database using the SharePoint portal intake forms. The appropriate qualifiers and codes that have been added to the result_comment field in the .RES.USB file will be included in the submission.

Data Usability Report

Data usability reports will be generated as required for characterization or final reporting to the agencies. Each consultant will be responsible for their own VUA report. A VUA report template will be created for consistency in reporting. The template will be completed using the Data Usability Checklist completed by the chemist.

Revision History

Revision Record			
Revision	Description	Prepared By	
1.0	Initial creation of document	Gus Sukkurwala/Jennifer Menges/ Andrew Bradley	5/31/2015

Reason Codes

Reason Code	Reason Description
General Use	
EC	Result exceeds the calibration range.
HT	Holding time requirement was not met
MB	Method blank or preparation blank contamination
LCS	Laboratory control sample evaluation criteria not met
FB	Field blank contamination
RB	Rinsate blank contamination
SQL	The analysis meets all qualitative identification criteria, but the measured concentration is less than the reporting limit.
FD	Field duplicate evaluation criteria not met
TvP	Total to Partial criteria not met
RL	Reporting limit exceeds decision criteria (for non-detects)

Reason Code	Reason Description
Inorganic Methods	
ICV	Initial calibration verification evaluation criteria not met
CCV	Continuing calibration verification evaluation criteria not met
CCB	Continuing calibration blank contamination
PB	Preparation Blank
ICS	Interference check sample evaluation criteria not met
D	Laboratory duplicate or spike duplicate precision evaluation criteria not met
MS	Matrix spike recovery outside acceptance range
PDS	Post-digestion spike recovery outside acceptance range
MSA	Method of standard additions correction coefficient _0.995
DL	Serial dilution results did not meet evaluation criteria
Organic Methods	
TUNE	Instrument performance (tuning) criteria not met
ICAL	Initial calibration evaluation criteria not met
CCAL	Continuing calibration evaluation criteria not met
SUR	Surrogate recovery outside acceptance range
MS/SD	Matrix spike/matrix spike duplicate precision criteria not met
MS	Matrix spike recovery outside acceptance range
IS	Internal standard evaluation criteria not met
LM	The PFK lock mass SICPs indicate that ion suppression evident
ID	Target compound identification criteria not met
Results Reported for Analytes Analyzed Multiple Times	
NSR	Not selected for reporting because the result was qualified as unusable
NSDL	Not selected for reporting because diluted resulted was selected for reporting
NSQ	Not selected for reporting because result was lesser quality based on data validation
NSO	Not selected for reporting because of other reason
Bias Codes	
H	Bias in sample result likely to be high
L	Bias in sample result likely to be low
I	Bias in sample result is indeterminate

3.5 Verification and Validation Summary

Field data will be verified by reviewing field documentation and chain-of-custody records. Data from direct-reading field instruments will be verified by reviewing calibration and operating records and the QC data specified in this QA/QC Plan.

Verification of sample collection procedures consists of reviewing sample collection documentation for compliance with the requirements of the workplan and QA/QC Plan. If alternate sampling procedures were used, the acceptability of the procedure will be evaluated to determine the affect on the usability of the data. Data usability will not be affected if the procedure used is determined to be an acceptable alternative that fulfills the measurement performance criteria in this QA/QC Plan.

The results of the data verification/ validation procedure will identify data that do not meet the measurement performance criteria of this QA/QC Plan. Data verification/validation will determine whether the data are acceptable, of limited usability (qualified as estimated), or rejected. Data

qualified as estimated will be reviewed and a discussion of the usability of estimated data will be included in the data validation report.

Data determined to be unusable may require corrective action to be taken. Potential types of corrective action may include resampling by the field team or reanalysis of samples by the laboratory. The corrective actions taken are dependent upon the ability to mobilize the field team and whether or not the data are critical for project DQOs to be achieved.

3.6 Verification and Validation Summary

Data use limitations will be identified in data usability write up. Field information will be reviewed to ensure that all sampling procedures and field measurements were conducted in accordance with the requirements of the Site Specific Field Activities and SOPs. Field measurements obtained or data from samples collected using procedures inconsistent with the requirements of the Site Specific Field Activities and SOPs will be evaluated and may require that additional samples are collected or the use of the data be restricted.

EVERGREEN FIELD PROCEDURES
PHILADELPHIA REFINERY COMPLEX
PHILADELPHIA, PENNSYLVANIA

1. LIQUID LEVEL ACQUISITION

Responsible Personnel: Technicians and Geologists

Training Qualifications:

All field personnel involved in liquid level acquisition shall have, as a minimum, completed OSHA 40 HOUR HAZWOPER training, PSM training, and obtained a TWIC Card as well as completing the 3-day minimum field training requirements as specified within the Corporate Health and Safety Plan. Prior to solo performance of liquid levels, all field personnel will have performed a minimum of three site visits under the direct supervision of experienced personnel.

Health and Safety Requirements:

Personal Protective Equipment (PPE) Required:

Level D attire including steel toe/steel shank boots, NOMEX coveralls, and an H2S meter are required to be worn. Based on site conditions, Level C attire may be required. The PPE required to upgrade to Level C may include: nitrile gloves, disposable outerboots, Tyvek coveralls, and a respirator. Safety glasses or hard hats may also be required in certain areas.

Site Controls:

Safety cones and or caution tape should be used in high traffic areas. The "Buddy System" may also be employed in high traffic areas.

Potential Hazards:

Traffic, pinch and trip, chemical (airborne and physical contact) and biological are all likely hazards to be encountered on-site. Additional hazards are mentioned in the site-specific HASP.

Materials and Equipment Necessary for Task Completion:

Electronic oil/water interface probe or conductivity water line, decontamination supplies (liquinox, deionized-distilled water, appropriate containers, scrub brush, and sorbent pads or paper towels), and air monitoring instruments (optional, based on previous site visits).

Methodology:

The task involves the deployment of a liquid sensing probe into a well (in most cases), recording the reading, and decontaminating the probe. The recorded field readings can then be utilized for one of several applications including: well sampling, water table gradient mapping, separate-phase hydrocarbon occurrence, thickness, and or gradient mapping, and various testing procedures.

The proper procedure for liquid level acquisition from a well is as follows:

1) The wells should be gauged in order of least to most contaminated based on existing sampling data or separate-phase hydrocarbon occurrence.
2) The gauging instrument is decontaminated prior to initial deployment and after each well to prevent cross contamination between wells.
3) Decontamination procedures include the following steps:
    a) Remove gross contaminants with sorbent pad or towel.
    b) Rinse/scrub equipment with water.
    c) Scrub equipment in Liquinox®/deionized-distilled water solution.
    d) Double rinse with deionized-distilled water.
    e) Air dry.
4) The well(s) to be gauged may need to be marked off with safety cones and or caution tape in order to protect personnel from auto traffic; the "Buddy System" may also be employed.
5) The manhole cover is then lifted off of the well head. A pry bar may be needed to prevent personal injury in the case of large manhole covers.
6) The probe is lowered into the well until the instrument signals contact with liquid.
7) The corresponding reading is recorded when the instrument signals either water or product. A clear bailer may be used to verify the existence or approximate amount and appearance of product.
8) The probe is then retracted from the well and decontaminated accordingly.
9) The well is then secured appropriately.
10) Note the start and stop time for gauging round in the field book.

2. GROUNDWATER MONITORING PROCEDURES

Responsible Personnel: Technicians and Geologists

Health and Safety Requirements:

Site specific HASP must be completed and reviewed by field personnel. Ambient air monitoring will be performed quarterly at all treatment areas to determine the necessity of PPE upgrade. As a minimum, level "D" attire will be worn.

Training Qualifications:

All field personnel involved in groundwater monitoring shall have, as a minimum completed OSHA 40 HOUR HAZWOPER training and completed the 3 day minimum field training requirements. Prior to groundwater monitoring, all field personnel will have sampled a minimum of three sites under the direct supervision of experienced personnel. Field personnel will also have experience in vapor monitoring techniques and sampling equipment decontamination.

Materials and Equipment Necessary for Task Completion:

A list of equipment required to access, gauge, purge, and sample site monitoring wells is presented below. Also listed are materials necessary to store, label, preserve, and transport groundwater samples.

- Current site map detailing well locations;
- Field data book for recording site data;
- Liquid level gauging device (graduated, optical interface probe);
- Keys and tools to provide well access;
- Appropriate sample containers and labels: volatile samples will be collected in laboratory provided 40 milliliter (ml) glass vials with plastic caps fitted with Teflon ® lined septa; all sample bottles will be laboratory sterilized and will contain the appropriate preservative, if applicable;
- Appropriate well purging apparatus as determined by volume of groundwater to be purged and compounds to be analyzed;
- Teflon ® (or equivalent) bottom-loading bailer to extract groundwater sample;
- Clean nylon or polypropylene bailer cord;
- Disposable nitrile sampling gloves;
- Decontamination supplies;
- Calibrated five-gallon bucket and watch or stopwatch to determine discharge rate during purging;

- Blank chain-of-custody forms; and
- Cooler and ice for sample preservation.

Methodology for Three Well Volume Sampling:

Prior to actual site visitation for the groundwater sampling event, the following data will be reviewed to ensure proper preparation for field activities:

- Most recent liquid level data from all wells;
- Most recent analytical data from all wells to determine gauging and sampling sequence; and
- Well construction characteristics.

Each monitoring well to be sampled will be gauged to obtain liquid level data immediately prior to initiation of the sampling process. Refer to Liquid Level Gauging SOP for appropriate well gauging procedures. Liquid level data will be recorded in a field book. Should free-phase petroleum product be detected by the gauging process and verified through inspection in a pre-cleaned acrylic bailer, groundwater sampling will not be conducted at that location.

The sampling procedure will be initiated by purging from the well a minimum of three well volumes, except in cases where the well is pumped dry, as referenced below. Well purging is performed to remove stagnant water and to draw representative water from the aquifer into the well for subsequent sampling and analysis for the established parameters. In extreme cases where a well is pumped dry and/or shows little recharge capacity, the well will be evacuated once prior to sample procurement. Well volume calculations will be based on total well depth as determined during well installation and depth-to-water measurements obtained immediately prior to sampling.

Down-hole pre-purge, post-purge, and sampling water quality readings will be collected. The parameters to be monitored and recorded will include dissolved oxygen, turbidity, pH, specific conductance, redox potential, and temperature.

Well purging can be performed with various equipment including: a dedicated bailer for hand bailing low volumes of water; a surface mounted electric centrifugal pump with dedicated polyethylene tubing; and/or submersible pump (when the depth to water is greater than 20 feet) with dedicated polyethylene tubing. During pumping, the intake will be placed directly below the static water surface and slowly lowered during the purging process. This procedure may not prove necessary in low-yielding wells but is important in high-yielding, permeable strata where

an intake initially placed deep in a well may draw laterally and have little influence in exchanging water from shallower depths within the well bore.

Flow rate during well purging will be approximated by the bucket and stop watch method. The duration of pumping required to remove three well volumes will be calculated directly from this flow rate. All fluids removed during purging will be treated on-site with activated carbon.

The sequence of obtaining site groundwater samples will be based upon available historical site data for existing wells and soil organic vapor analyzer (OVA) readings for newly installed wells. Site wells will be sampled in order from the lowest to highest concentration of water quality indicator parameters based upon the most recent available set of laboratory analyses to reduce the potential for sample cross-contamination. Groundwater samples will not be obtained for analysis from any well containing measurable free product.

The following sequence of procedures will be implemented for the collection of groundwater samples from monitoring wells.

1) Establish a clean work area where sampling equipment will not come in contact with the ground or any potentially contaminated surfaces.
2) Use a laboratory, pre-cleaned Teflon® sampling bailer for each well.
3) Use a clean pair of nitrile gloves.
4) Attach an appropriate length of unused, clean nylon or polypropylene cord to the designated sampling bailer.
5) Select appropriate laboratory-sterilized sample containers.
6) Slowly lower sampling bailer into well until water surface is encountered; continue to lower the sampling bailer into the standing water column to one foot below the water surface.
7) Retrieve bailer at a steady rate to avoid excess agitation.
8) Visually inspect bailed sample to ensure that no free product or organic detritus has been collected.
9) Uncap first designated sample vial and fill from bailer as rapidly as possible but minimizing agitation; secure septum and lid.
10) Inspect sealed sample for entrapped air; if air is present within sample vial. Remove lid and repeat vial filling, sealing and inspection process until no air is present.
11) Repeat Steps 9 and 10 for the second designated vial; all volatile parameter samples will be collected in duplicate.

12) Complete and attach labels to sample containers noting sample collector, date, time, and location of sample; record same data in field book.

13) Place samples in ice-filled cooler in such a manner as to avoid breakage. Samples collected for VOC analysis will be maintained at a temperature of 4°C.

Discard gloves and bailer cord and move to next sample location.

Methodology for Low-Flow Purging and Sampling:

For wells that will be Low-Flow purged and sampled, the USEPA Region III Bulletin QAD023: *Procedure for Low-Flow Purging and Sampling of Groundwater Monitoring Wells* will be followed. The following data will be reviewed for each well in order to set the pump intake for the low flow sampling:

- Soil boring (lithologic) log and continuous soil sample PID;
- Well construction log showing the screened interval;
- Identification of the most permeable zone screened by the well;
- Approximate depth to static water;
- Proposed pump intake setting; and
- Technical rationale for the pump intake setting, preferably across from the most impacted/contaminated subsurface interval.

Equipment

Adjustable rate, submersible, bladder pumps in conjunction with Teflon® or Teflon-lined polyethylene tubing for purging and sampling will be used. An alternate set up would include a stainless steel submersible Hurricane Pump with Teflon-lined tubing. The tubing diameter will be between 3/16-inch to ½-inch inner diameter and the length of the tubing extended outside the well will be minimized. Flow through cells will be used to evaluate parameters during sampling. Monitoring well information, equipment specifications, water level measurements, parameter readings, and other pertinent information will be recorded during monitoring well purging and sampling.

Sampling Procedure

The following protocol details the low-flow sampling procedure that will be used for sampling the monitoring wells.

1. PID Screening of Well. A PID measurement will be collected at the rim of the well

immediately after the well cap will be removed and recorded on the sampling form.

2. Depth to Water Measurement. A depth to water measurement will be collected and recorded. To avoid disturbing accumulated sediment and to prevent the inadvertent mixing of stagnant water, measuring the total depth of the well will be done at the completion of sampling on an annual basis.

3. Low Stress Purging Startup. Water pumping will commence at a rate of 100 to 400 milliliters per minute (mL/min). This pumping should cause very little drawdown in the well (less than 0.2-0.3 feet) and the water level should stabilize. Water level measurements are made continuously and will be recorded in milliliters per minute on the sampling form.

4. Low Stress Purging and Sampling. The water level and pumping rate will be monitored and recorded every five minutes during purging, and any pumping rate adjustments will be recorded. During the early phase of purging, emphasis will be placed on minimizing and stabilizing pumping stress, and recording any necessary adjustments. Adjustments, when necessary, will be made in the first 15 minutes of purging. If necessary, pumping rates will be reduced to the minimum capabilities of the pump to avoid well dewatering. If the minimal drawdown exceeds 0.3 feet, but the water level stabilizes above the pump intake setting, purging will continue until indicator field parameters stabilized, as detailed in Step 5 below. If the water level drops below the pump intake setting at the absolute minimum purge rate, the pump will remain in place and the water level will be allowed to recover repeatedly until there will be sufficient water volume in the well to permit the collection of samples.

5. Indicator Field Parameters Monitoring. During well purging, indicator field parameters (DO, turbidity, pH, specific conductance, and redox potential) will be monitored every five minutes (or less frequently, if appropriate). Purging will be considered complete and sampling began when all the aforementioned indicator field parameters had stabilized. Stabilization will be achieved when three consecutive readings, taken at five (5) minute intervals (or less frequently, if appropriate), are within the following limits:

    - DO (±10 percent);
    - turbidity (±10 percent);
    - specific conductance (±3 percent);
    - pH (± 0.1 unit); and
    - redox potential [Eh] ±10 mv).

    Temperature and depth to water will be also monitored during purging. Should any of the parameter-reading components of the flow-through meter fail during sampling; the sampling team will attempt to locate a replacement flow-through meter. If none is available, the

sampling team will measure that parameter with an individual criteria meter. Any other field observations relating to sample quality, such as odor, foaming, effervescence, and sheens, will also be recorded on the sampling form.

6. Collection of Ground Water Samples. Water samples for laboratory analyses will be collected before the groundwater had passed through the flow-through cell by either using a by-pass assembly or by temporarily disconnecting the flow-through cell. All sample containers will be filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. During purging and sampling, the tubing remains filled with water in order to minimize possible changes in water chemistry upon contact with the atmosphere. Methods employed to ensure that the outlet tubing will be filled include (i) adjusting the tubing angle upward to completely fill the tubing and (ii) restricting the diameter of the tubing near the outlet of the tubing.

   The order in which samples will be collected is as follows:

   - Volatile organics;
   - Gas sensitive (e.g., Fe^{+2}, CH_4, H_2S/HS);
   - Base/Neutrals or PAHs;
   - Total Petroleum Hydrocarbons;
   - Total metals;
   - Dissolved metals;
   - Cyanide;
   - Sulfate and chloride;
   - Nitrate and ammonia;
   - Preserved inorganic;
   - Non-preserved inorganic; and
   - Bacteria.

Decontamination Requirements:

Numerous practices are employed throughout the processes of site investigation and sampling to assure the integrity of the resulting data. Of particular significance to the procedures of

groundwater measurement and sampling is the limitation, whenever possible, of materials inserted into a well bore and, even more importantly, of materials transferred from well to well.

Many items can be discarded between well sampling and/or gauging locations without significantly impacting project costs. Dedicated sampling equipment which can be discarded between well sampling locations without significantly impacting project costs, will be used whenever possible to preclude decontamination requirements. Sampling equipment included in this category are Teflon ® bailers, nitrile gloves, and bailer cord. However, other investigative and sampling equipment, including such items as liquid level probes, must be reused from well to well.

The danger in multi-well equipment applications lies in the potential of cross-contamination. While the threat of cross-contamination is always present, it can be minimized through the implementation of a consistent decontamination program during sensitive site measurement and data collection activities. The decontamination procedure is outlined below:

All site equipment used in a multi-well capacity will be decontaminated immediately prior to initial use and between each well. Standard site decontamination procedures for the optical interface probes between wells will be performed according to the following schedule:

- Initial rinse with clean tap water to remove excess residuals;
- Scrub equipment with sponge or clean, soft cloth in a distilled water/Liquinox@ (or equivalent) solution; and
- Double rinse with deionized/distilled water.

Rinse water generated during decontamination procedures will be treated on-site by passing the water through a bucket filled with activated carbon prior to disposal.

3. SOIL SAMPLING & WELL INSTALLATION

Responsible Personnel: Geologist

Training Qualifications: All field personnel supervising drilling activities shall have completed OSHA 40-Hour training, and three days of field training. Personnel supervising the well installation shall have observed drilling procedures for a minimum of three under the direct supervision of experienced personnel. Field personnel will have experience in operating the following field equipment: interface probe and photo-ionization detector (PID). Personnel should be able to describe soils encountered during drilling for generation of well logs.

Health and Safety Requirements:

A site specific HASP must be completed and reviewed by all field personnel. Prior to deploying a rig to the site, a utility call must be made (i.e. Pennsylvania One-Call) to allow mark-out of known subsurface utilities and associated laterals proximal to the site. Site plans, if available, should be reviewed to document and avoid the location of on-site utilities. No drilling should occur on retails sites within the exclusion zone. This zone is defined as the area between the pumps, the tank field and the station building. The area is excluded from drilling activities due to the likely occurrence of subsurface petroleum distribution lines. After review of all known mapped and marked utilities, a site reconnaissance will be performed to document the location of utility meters and storm sewer drains. In addition, the location of overhead utilities must be documented. After completing the subsurface and overhead utility review, the area to drill may be observed as clear or the location may be adjusted to a "clear" location.

Once the drilling location is established, the area must be marked with cones to alert area traffic of the work area. Other health and safety concerns include slip/trip hazards, working with heavy equipment and overhead work hazards. During drilling activities, a minimum of protective work gloves, steel toed boots, hard hats, and safety goggles must be worn.

A final health and safety requirement includes hand clearing the borehole, prior to advancing the borehole with the drill rig. To ensure the safety of workers, the borehole will be cleared by hand or air knife, to depth of 5 feet below ground surface. This will serve to clear the area of utilities, prior to drilling.

Decontamination Requirements:

All down-hole equipment must be steam cleaned prior to drilling at each boring/well location. All soil sampling equipment must be cleaned with detergent and rinsed with distilled water prior to deployment into the borehole. All well construction materials (i.e. PVC well casing, PVC well screen, sand pack, bentonite seal) should be clean and dedicated to each hole.

Methodology for Borings Outside RCRA Areas in AOI 5:

1) Borehole Advancement

During soil sampling or well installation activities, a borehole is advanced into the unconsolidated subsurface materials or bedrock via a drill rig (or similar). Various types of drilling methods could be deployed to advance the hole. A description of each drilling method is included below:

a) Hollow Stem Auger

A spiral tool form is used to move material from the subsurface to the surface. A bit at the bottom cuts into the subsurface material. Spiral augers on outside convey the material to the surface while spinning. The center of the auger is hollow like a straw when the inner drive rods and plug are removed. During drilling or formation cutting, the center is filled with rods connected to a plug at the bottom bit. Once the desired drilling depth is reached, the center plug and rods can be pulled out, leaving the hollow augers in place. The hollow augers hold the borehole to remain open for sediment sampling and well installation.

b) Air Rotary

A drill bit at the bottom of rods is used to cut into the subsurface material. Air injected into the drill rods escapes through small holes in the drill bit and conveys the drill cuttings to the surface.

c) Geoprobe®

The geoprobe® sampling allows collection of soil by directly pushing (through hydraulic hammering) a sampling device lined with a plastic macrocore into the soil column.

d) Hand Auger

A stainless steel or aluminum hand auger will be physically advanced to the desired soil sampling depth.

2) Soil Sampling

Soil samples will be obtained for lithologic logging and laboratory analysis for chemical contaminants with one of three different sampling devices: Split barrel spoon sampler, hand auger or Geoprobe® soil sampler. For either method, the sampling devices are lowered through the hollow-stem augers or open borehole to allow sampling of the undisturbed sediments below the auger bit. Soil samples will be collected at intervals which appear to be visually impacted or from intervals which exhibit the highest deflections on the screening device (PID or similar).

a) Split barrel spoon sampler (split spoon)

The split spoon sampler will be driven into the soil column in accordance with ASTM Standard Method D1586 (Reference A6, Appendix E). Soil sampling by split barrel spoon will entail drilling a borehole with a hollow-stem auger to the desired sampling depth (standard five foot intervals). After augering to the desired depth, slowly and carefully lower the split barrel spoon sampler attached to the drill rod extension into the borehole. Drive the sampler into the soil by repeated blows from a 140 Lb. hammer with 30 inch travel. Record the blow counts required to drive the split spoon sampler each successive six inch interval.

Remove sampler for borehole, split barrel open, remove soil sample utilizing a stainless steel knife to trim the top and edges of the sample and containerize sample in appropriate sample jar.

b) Geoprobe®

The geoprobe® liner is dedicated to each soil sampling interval. After retrieval of the sample, the liner may be sliced open and the soil sample can be logged and containerized in the appropriate sample jar. During shallow soil sampling from fine-grained sediments, the geoprobe® can advance the sampler directly into the ground, without the advance of an augered borehole.

c) Hand Auger

The hand auger allows for soil from the desired interval to be collected directly by removing the soil column that is contained in the auger portion of the device.

Methodology for Well Installations:

1) Well Construction

After drilling to the desired depth or the desired interval, permanent monitoring wells can be installed to allow groundwater sampling. In general, wells are constructed with slotted screen, which allows groundwater to flow into the well at the desired monitored interval and well casing, which restricts groundwater flow into the well from undesired interval. In most cases the well materials are constructed of PVC. In conditions where the shallowest groundwater interval is monitored, a single case construction monitoring well is installed. In conditions where multiple water bearing units occur and deep groundwater conditions are selected for monitoring, a double cased well is installed.

a) Single Casing Construction

The construction details of a monitoring well are determined by soil type, depth to groundwater and relative fluctuation of groundwater level. After drilling to the desired depth, a monitoring well is constructed for installation into the evacuated borehole. The well consists of a bottom cap, a length of screen and length of well casing. To determine the length of screen used, seasonal groundwater table or tidal fluctuations should be considered to allow the water table to intercept the well screen throughout the year. The assembled well is then inserted into the borehole.

The annular space between the well screen and subsurface is filled with a sand pack, which consists of clean, sorted sand. The sand pack allows water flow into the well but acts as a

filter to prevent subsurface sediments from silting in the well. The sand pack extends one to two feet above the top of well screen. Above the sand pack, a seal is installed in the annular space between the well casing and the subsurface. The seal is comprised of hydrated bentonite and prevents surface water from infiltrating the well screen. Above the well seal, the annular space is backfilled with drill cuttings or cement. A cap is placed on the top of the well to further prevent infiltration of the surface water. The top of the well is protected with either a stand-up pipe or a locking, flush mount box.

b) Double Casing Construction

In cases where multiple water bearing zones occur, a double case well is installed to allow monitoring of the deeper water bearing zones. Construction of a double cased well is similar to that of a single case well; however, to prevent groundwater infiltration from shallower water bearing zones, a second casing is installed. This type of construction requires drilling two different diameter boreholes.

During drilling through the shallower groundwater zones, large diameter augers/bits are used to create a large diameter borehole. The borehole is advanced through the shallower water bearing area which will not be monitored. An outer casing is installed to seal the deeper monitoring well from infiltration from the shallow water bearing zones. After the outer casing is installed, the borehole is advanced deeper with smaller diameter auger/bit. The outside diameter of second augers fit within the inside diameter of the outer casing. The borehole is advanced to allow monitoring of the deeper water bearing zone. Once the desired depth is obtained, a monitoring well is installed within the outer casing, using similar methods as described in the single casing construction (3a, above). The outside casing prevents shallow groundwater infiltration into the well. The inside casing prevents surface water infiltration into the well.

2) Soil Cutting Handling

Cuttings generated from drilling will be containerized or stock-piled, undercover, until appropriate disposal is determined. In the case the soils are not impacted, the cuttings may remain on-site. Impacted soils will be removed using appropriate hazardous waste handling procedures and disposed of with an approved hazardous waste handler.

3) Well Development

After installation, monitoring wells are developed to remove residual sediments within the well and annular space. Water is pumped from the well a low flow rate (to minimize turbulence within the well and associated sand pack) until groundwater flowing from the well appears relatively free of sediments.

Documentation:

All site activities should be detailed in the site investigators fieldbook. The entry shall include the date, time, weather, address, and persons present on-site. In addition, data required to create well construction logs or boring logs (if no well is constructed) should be collected. This data includes soil type, relative moisture content, depth of water table, observed impact, soil screening measurements (if PID is used), blow counts (if split spoon samples are collected), sample recovery, depth of borehole, length of well screen, length of well casing(s), sand pack interval, well seal interval. The site investigator should identify the relative location and number.

4. NON-AQUEOUS PHASE LIQUID (NAPL) SAMPLING PROCEDURES

Responsible Personnel: Technicians and Geologists

Training Qualifications:

All field personnel involved must have completed OSHA 40 HOUR HAZWOPER training. Prior to NAPL sampling, all field personnel will have worked a minimum of three sites under the direct supervision of experienced personnel. Field personnel will also have experience in sampling and vapor monitoring techniques and sampling equipment decontamination.

Materials and Equipment Necessary for Task Completion:

A list of equipment required to sample NAPL from a monitoring well is presented below:

- Current site map detailing well locations;
- Field data book for recording site data;
- Liquid level gauging device (graduated, optical interface probe);
- Keys and tools to provide well access;
- Appropriate sample containers and labels. NAPL samples will be collected in laboratory provided 40 milliliter (ml) glass vials with plastic caps fitted with Teflon ® lined septa; all sample bottles will be laboratory sterilized and will contain the appropriate preservative, if applicable. A minimum of 10 ml is required for laboratory analysis. In the case that sufficient volume is not obtained, a swabbing technique (described below) will be used;
- Sorbent pads (required for swabbing technique);
- Teflon ® (or equivalent) bottom-loading bailer to obtain NAPL sample;
- Clean nylon or polypropylene bailer cord;

- Decontamination supplies;
- H&S supplies (tyvek, nitrile gloves, safety goggles);
- Blank chain-of-custody forms; and
- Cooler and ice for sample preservation.

Health and Safety Requirements:

Site specific HASP must be completed and reviewed by field personnel. As a minimum, modified Level "D" attire will be worn. Individuals performing NAPL sampling are required to wear safety goggles, tyvek suit, and nitrile sampling gloves.

Decontamination Requirements:

During NAPL sampling activities, dedicated sampling equipment (i.e. Teflon ® bailers, nitrile gloves, and bailer cord) are utilized; thereby, eliminating decontamination requirements. The interface probe, used to record the presence of NAPL and relative thickness prior to sampling, does require decontamination between sampling locations.
All site equipment used in a multi-well capacity will be decontaminated immediately prior to initial use and between each well. Standard site decontamination procedures for the optical interface probes between wells will be performed according to the following schedule:

- Initial rinse with clean tap water to remove excess residuals;
- Scrub equipment with sponge or clean, soft cloth in a distilled water/Liquinox® (or equivalent) solution; and
- Double rinse with deionized/distilled water.

Methodology:

Each monitoring well to be sampled will be gauged to obtain liquid level and relative NAPL thickness immediately prior to initiation of the sampling process. Refer to SOP No. 1 for appropriate well gauging procedures. Liquid level data will be recorded in a field book.

Sampling of the NAPL will occur via two different methods: direct sample or swabbing.

The following sequence of procedures will be implemented for the collection of groundwater samples from monitoring wells.

1) Establish a clean work area where sampling equipment will not come in contact with the ground or any potentially contaminated surfaces.

2) Use a laboratory, pre-cleaned Teflon® sampling bailer for each well.
3) Don an unused, clean pair of nitrile gloves.
4) Attach an appropriate length of unused, clean nylon or polypropylene cord to the designated sampling bailer.
5) Select appropriate laboratory-sterilized sample containers.
6) Slowly lower sampling bailer into well until water surface is encountered; continue to lower the sampling bailer into the standing water column to one foot below the water surface.
7) Retrieve bailer at a steady rate to avoid excess agitation.
8) Visually inspect bailed sample to ensure for relative thickness of NAPL. If sufficient volume is present (>10 ml) place a direct sample of the NAPL into the laboratory vial. If less than 10 ml of NAPL is present, use a sorbent pad to absorb the NAPL from the surface of the groundwater sample. Place is swab sample into the laboratory vial.
9) Complete and attach labels to sample containers noting sample collector and date, time, and location of sample; record same data in field book.
10) Place samples in ice-filled cooler in such a manner as to avoid breakage. Samples collected for VOC analysis will be maintained at a temperature of 4°C.
11) Discard gloves and bailer cord and move to next sample location.

Documentation:

All site activities should be detailed in the site investigators fieldbook. The entry shall include the date, time, weather, address, persons present on-site, and the aforementioned parameters. Only relevant observations should be recorded. The nature of the work being performed is also appropriate.

1.1 Field Procedures for Surface Water Sampling

1.1.1 General

Surface water sampling is performed to obtain samples for surface water bodies that are representative of existing surface water conditions.

Surface water sampling locations for surface water quality and groundwater interaction studies are selected based on the following:

1. Study objectives
2. Location of point surface discharges
3. Non-point source discharges and tributaries
4. Presence of structures (e.g., bridge, dam)
5. Accessibility

During surface water sampling it is important to obtain samples that are not impacted by the re-suspension of sediment produced because of improper or poor surface water sampling techniques.

1.1.2 Surface Water Sample Location Selection

Prior to conducting surface water sampling activities, the first requirement is the consideration and development of surface water sampling locations. It is important that all surface water sampling locations be selected in accordance with the Work Plan.

Wading for surface water samples increases the chances of disturbance of sediments from the floor of the surface water body.When wading for surface water samples be aware of potential safety and health risks. A life vest and safety line must be worn at all times where footing is unstable or when sampling in fast moving or more than 3 feet (0.9 m) deep. A two-person team is required for most surface water sampling activities. If the site conditions require the use of the life vest and safety line, the two people involved in the sampling must be competent swimmers.

Surface water samples must be collected with no suspended sediments. Surface water samples are collected commencing with the furthest downstream location to avoid sediment interference with upstream locations.

1.1.2.1 Rivers, Streams, and Creeks

Surface water samples are generally collected in areas of surface water bodies that are representative of the surface water body conditions. Representative surface water samples will usually be collected in sections of surface water bodies that have a uniform cross section and flow rate. Mixing is influenced by turbulence and water velocity, therefore the selection of surface water sampling locations immediately downstream of a riffle area (i.e., fast flow zone) will ensure good vertical mixing. These locations are also likely areas for deposition of sediment since this occurs in areas of decreased flow velocity.

Surface water sampling locations should not be established in areas near point source discharges. Surface water sampling of these source discharge points can be performed to assess the impact of

these source areas on overall surface water quality.Sample tributaries as close to the mouth as possible. It is important to select surface water sample locations considering the impact downstream, including tributary flow and sediment.

In all instances, properly document all surface water sampling locations. Documentation may include photographs and tie-ins to known structures.

1.1.3 Sampling Equipment and Techniques

When collecting surface water samples, direct dipping of the sample container into the stream or water is acceptable unless the sample container contains preservatives. If preserved, a pre-cleaned unpreserved sample container should be used to collect the surface water sample. The surface water sample is then transferred to the appropriate preserved sample container. When collecting surface water samples, submerse the inverted bottle to the desired sample depth and tilt the opening of the sample container upstream to fill. During surface water sample collection, wading or movement may cause sediment deposits to be re-suspended and can result in biased samples. Wading is acceptable if the stream has a noticeable current and the samples are collected directly in the sample container when faced upstream. If the stream is too deep to wade in or if addition samples must be collected at various depths, additional sampling equipment will be required. Surface water samples should be collected about 6 inches (15 cm) below the surface, with the sample bottles being completely submerged. Taking the surface water sample at this depth eliminates the collection of floating debris in the sample container.

Surface water sample collection where the flow depth is less than 1 inch (<2.5 cm) requires the use of special equipment to eliminate sediment disturbance. Surface water sampling may be conducted with a container then transferred to the appropriate sample container, or collection may be performed using a peristaltic pump. A small excavation in the stream bed to create a sump for sample collection can also be considered but should be prepared in advance to allow all the sediment to settle prior to surface water sampling activities.

Teflon™ bailers can be used for surface water sampling if it is not necessary to collect surface water samples at specific depths. A bottom loading bailer with a check ball is sufficient. When the bailer is lowered through the water, the water is continually displaced through the bailer until the desired depth is reached. The bailer is retrieved and the check ball prohibits the release of the collected surface water sample. Bailers are not suitable in surface water bodies with strong currents, or where depth-specific sampling is required.

For discrete and specified depth surface water sampling, and the parameters to be monitored do not require a Teflon™ coated sampling device, a standard Kemmerer or Van Dorn sampler can be used. The Kemmerer sampler is a brass cylinder with rubber stoppers that leave the sampler ends open while the sampler is being lowered. The sampler is lowered in a vertical position to allow water to pass through. The Van Dorn sampler is plastic and is lowered in a horizontal position. For both samplers, a messenger is sent down a rope when the sampler has reached the required depth. The messenger causes the stopper on the sampler to close. The sampler is then retrieved and the surface water sample can be collected through a valve. DO sample bottles can be filled by allowing overflow using a rubber tube attached to the valve. During depth-specific surface water sampling, take care not to disturb bottom sediments.

Glass beakers or stainless steel cups may also be used to collect surface water samples if parameter interference does not occur. The beaker or cup must be rinsed at least three times with the surface water sample prior to sample collection.

All equipment must be thoroughly decontaminated.

1.1.4 Field Notes for Surface Water Sampling

Record daily surface sampling activities, describe surface water sampling locations, sampling techniques, and, if applicable, provide a description of photographs taken. Visual observations are important and provide valuable information when interpreting surface water quality results. Observations include:

1. Weather conditions
2. Stream flow directions
3. Stream physical conditions (width, depth, etc.)
4. Tributaries
5. Effluent discharges
6. Impoundments
7. Bridges
8. Railway trestles
9. Oil sheens
10. Odors
11. Buried debris
12. Vegetation
13. Algae
14. Fish and other aquatic life
15. Surrounding industrial areas

The following factors should be considered for surface water sampling:

1. Predominant Surrounding Land Use: Observe the prevalent land use type in the vicinity and note any other land uses in the area which, although not dominant, may potentially affect surface water quality.
2. Local Watershed Erosion: Note the existing or potential erosion of soil in the local watershed and its movement into the stream. Erosion can be rated through visual observation of watershed stream characteristics including increases or decreases in turbidity.
3. Local Watershed Non-Point Source Pollution: This refers to problems or potential problems other than erosion and sedimentation. Nonpoint source pollution can be diffuse agricultural and urban runoff. Other factors may include feed lots, wetlands, septic systems, dams, impoundments, and mine seepage.
4. Estimated Stream Width: The estimated distance from shore at a transect representative of the stream width in the area.

5. Estimated Stream Depth: Riffle (rocky area), run (steady flow area), and pool (still area). Estimate the vertical distance from the water surface to the bottom of the surface water body at a representative depth at three locations.
6. High Water Mark: Estimate the vertical distance from the bank of the surface water body to the peak overflow level, as indicated by debris hanging in bank or flood plain vegetation, and deposition of silt. In instances where bank flow is rare, high water marks may not be evident.
7. Velocity: Record or measure the stream velocity in a representative run area.
8. Dam Present: Indicate the presence or absence of a dam upstream or downstream of the surface water sampling location. If a dam is present, include specific information detailing the alteration of the surface water flow.
9. Channelized: Indicate if the area surrounding the surface water sampling location is channelized.
10. Canopy Cover: Note the general proportion of open to shaded areas which best describes the amount of cover at the surface water sampling location.

1.2 References

For additional information pertaining to surface water sampling, the user of this manual may reference the following:

ASTM D5358	Practice for Sampling with a Dipper or Pond Sampler
ASTM D4489	Practices for Sampling of Waterborne Oils
ASTM D3325	Practice for the Preservation of Waterborne Oil Samples
ASTM D4841	Practice for Estimation of Holding Time for Water Samples Containing Organic and Inorganic Constituents
ASTM D4411	Guide for Sampling Fluvial Sediment in Motion
ASTM D4823	Guide for Core-Sampling Submerged, Unconsolidated Sediments
ASTM D3213	Practice for Handling, Storing, and Preparing Soft Undisturbed Marine Soil
ASTM D3976	Practice for Preparation of Sediment Samples for Chemical Analysis
ASTM E1391	Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing
ASTM D4581	Guide for Measurement of Morphologic Characteristics of Surface Water Bodies
ASTM D5906	Guide for Measuring Horizontal Positioning During Measurements of Surface Water Depths
ASTM D5073	Practice for Depth Measurement of surface water

Sediment Sampling Standard Operating Procedures

Introduction

Sediment sampling is conducted to obtain samples that are representative of existing chemical and/or physical conditions of sediment.

Equipment Decontamination

On environmental sites, sediment sampling equipment (e.g., split spoons, trowel, spoons, shovels, bowls, dredges, corers, scoops) are typically cleaned as follows:

1. Wash with clean potable water and laboratory detergent, using a brush as necessary to remove particulates.
2. Rinse with tap water.
3. Rinse with deionized water.
4. Air dry for as long as possible.

Additional or different decontamination procedures may be necessary if sampling for some parameters, including volatile organic compounds (VOCs) and metals.

Sample Site Selection

Before any sampling is conducted, the first requirement is to consider suitable sampling locations. Sampling locations should be selected in accordance with the Work Plan. Wading for sediment samples in lagoons, lakes, ponds, and slow-moving rivers and streams must be done with caution since bottom deposits are easily disturbed. Sampling must only be attempted where safe conditions exist and samples must be collected from undisturbed sediments. All sediment samples are to be collected commencing with the most downstream sample to avoid sediment interference with other downstream samples. A life vest and safety line should be worn in all cases where footing is unstable or where water is fast moving or over 3 feet (0.85 m) in depth. A second person may also be required for most of the sampling scenarios.

Rivers, Streams, and Creeks

Sediment samples may be collected along a cross-section of a river or stream in order to adequately characterize the bed material, or from specific sediment deposits as described in the Work Plan. A common procedure is to sample at quarter points along the cross-section of the sampling site selected. Samples may be composited as described in the Work Plan. Samples of dissimilar composition (e.g., grain size, organic content) should not be combined.

Representative samples can usually be collected in portions of the surface water body that have a uniform cross-section and flow rate. Since mixing is influenced by turbulence and water velocity, the selection of a site immediately downstream of a riffle area (e.g., fast flow zone) are likely areas for deposition of sediment since the greatest deposition occurs where stream velocity slows.

A site that is clear of immediate point sources (e.g., tributaries and industrial and municipal effluents) is preferred for the collection of sediment samples unless the sampling is being performed to assess these sources.

Sampling Equipment and Techniques

General

Any equipment or sampling technique(s) [e.g., stainless steel, polyvinyl chloride (PVC)] used to collect a sample is acceptable so long as it provides a sample which is representative of the area being sampled and is consistent with the Work Plan.

Sediment Sampling Equipment and Techniques

A variety of methods may be used to collect sediment samples from a stream, river, or lake bed. Dredging (Peterson, Ponar, Van Veen), coring and scooping are acceptable sediment sample collection techniques. Precautions shall be taken to ensure that a representative sample of the targeted sediment is collected. Caution should be exercised when wading in shallow water so as not to disturb the area to be sampled. Samplers should be selected based on the interval to be sampled, type of sediment/sludge (silt, sand, gravel), and required sample volume. More than one sampler is often required to implement a sampling program at a site. The following describes some of these methods. Manufacturers information should be consulted to determine the limitations of each type of sampling equipment.

Dredging

The **Peterson dredge** is best used for rocky bottoms, in very deep water, or when the stream velocity is rapid. The dredge should be lowered slowly as it approaches the bottom, so as to not disturb the lighter sediments.

The **Ponar dredge** is similar to the Peterson dredge in size and weight. The Ponar dredge is a "clam-shell" type unit that closes on contact with the river/lake bottom. Depending on the size of the unit, a winch is required for larger units, whereas smaller units are available for lowering by a hand line. Once retrieved, the unit is opened and the sample extracted using a sample scoop or spoon. The unit has been modified by the addition of side plates and a screen on top of the sample compartment. This permits water to pass through the sampler as it descends.

The **Ponar grab** sampler functions by the use of a spring-latch-messenger arrangement. The sampler is lowered to the bottom of the water body by means of a rope, then the messenger is sent down to trip the latch causing the sampler to close on the sediments. The sampler is then raised slowly to minimize the disturbance of the lighter sediments. Sediment is then placed into a stainless steel bowl, homogenized, and placed into the appropriate sample container (if collecting for VOC parameters, fill the VOC jars before homogenization).

Corers

Core samplers are used to obtain vertical columns of sediment. Many types of coring devices are available, depending on the depth of water from which the sample is to be collected, the type of bottom material, and the length of core to be obtained. They vary from hand-push tubes to weight or gravity-driven devices to vibrating penetration devices.

Coring devices are useful in contaminant monitoring due to the minimal disturbance created during descent. The sample is withdrawn intact, allowing the removal of only those layers of interest. Core liners consisting of plastic or Teflon may also be added, thereby reducing the potential for sample contamination and maintaining a stratified sample. The samples may be shipped to the lab in the tubes in which they were collected. The disadvantage of coring devices is that only a small sampling surface area and sample size is obtained, often necessitating repetitive sampling in order to collect the required amount of sediment for analysis. It is also often difficult to extract the sediment sample back out through the water column without losing the sample.

The core tube is pushed/driven into the sediment until only 4 inches (10 cm) or less of tube is above the sediment-water interface. When sampling hard or coarse sediments, a slight rotation of the tube while it is pushed will create greater penetration and reduce compaction. Cap the tube with a Teflon plug or a sheet of Teflon. The tube is then slowly withdrawn, keeping the sample in the tube. Before pulling the bottom part of the core above the water surface, it must be capped.

Scooping

The easiest way to collect a sediment sample is to scoop the sediment using a stainless steel spoon or scoop. This may be done by wading into the stream or pond and, while facing upstream (into the current), scooping the sample from along the bottom in an upstream direction. This method is only practical in very shallow water.

Mixing

Sediment samples collected for chemical analysis should be thoroughly mixed (except for VOCs) in a stainless steel bowl prior to placement in the appropriate sample container. Standard procedures exist for preparation of sediment samples (ASTM D3976). These should be followed or the laboratory informed of applicable procedures.

Air Monitoring

Prior to sediment/sludge sampling, measure the breathing space above the sample location with a photoionization detector (PID), should the potential for volatiles be present, and use a hydrogen sulfide meter should hydrogen sulfide be present. Repeat these measurements during sampling. If either of these measurements exceed any of the air quality criteria established in the HASP, air purifying respirators (APRs) or supplied air systems will be required.

Sample Location Tie-In/Surveying

The recording of the sample locations and depth on the site plan is extremely important. This may be accomplished by manual measurement (i.e., swing ties), global positioning system (GPS) survey, or stadia methods. Manual measurements for each sample location should be tied into three permanent features (e.g., buildings, utility poles, hydrants). Diagrams with measurements should be included in the field book.

Field Notes

A bound field book is used to record daily activities, describe sampling locations and techniques, and describe photographs (if taken). Visual observations are important, as they may prove invaluable in interpreting water or sediment quality results. Observations shall include (as applicable) weather, stream flow conditions, stream physical conditions (width, depth, etc.),

tributaries, effluent discharges, impoundments, bridges, railroad trestles, oil sheens, odors, buried debris, vegetation, algae, fish or other aquatic life, and surrounding industrial areas. The following observations should be considered:

- **Predominant Surrounding Land Use**: Observe the prevalent land use type in the vicinity (noting any other land uses in the area which, although not predominant, may potentially affect water quality).
- **Local Watershed Erosion**: The existing or potential erosion of soil within the local watershed (the portion of the watershed that drains directly into the stream) and its movement into a stream is noted. Erosion can be rated through visual observation of watershed and stream characteristics. (Note any turbidity observed during water quality assessment.)
- **Local Watershed Non-point Source Pollution**: This item refers to problems and potential problems other than siltation. Non-point source pollution is defined as diffuse agricultural and urban runoff (e.g., stormwater runoff). Other compromising factors in a watershed that may affect water quality are feedlots, wetlands, septic systems, dams and impoundments, and/or mine seepage.
- **Estimated Stream Width**: Estimate the distance from shore at a transect representative of the stream width in the area.
- **Estimated Stream Depth**: Riffle (rocky area), run (steady flow area), and pool (still area). Estimate the vertical distance from water surface to stream bottom at a representative depth at each of the three locations.
- **High Water Mark**: Estimate the vertical distance from the stream bank to the peak overflow level, as indicated by debris hanging in bank or floodplain vegetation, and deposition of silt or soil. In instances where bank overflow is rare, a high water mark may not be evident.
- **Velocity**: Record an estimate of stream velocity in a representative run area (see Section 12.0).
- **Dam Present**: Indicate the presence or absence of a dam upstream or downstream of the sampling station. If a dam is present, include specific information relating to alteration of flow.
- **Channelized**: Indicate whether the area around the sampling station is channelized.
- **Canopy Cover**: Note the general proportion of open to shaded area which best describes the amount of cover at the sampling station.
- **Sediment Odors**: Disturb sediment and note any odors described (or include any other odors not listed) which are associated with sediment in the area of the sampling station.
- **Sediment Oils**: Note the term which best describes the relative amount of any sediment oils observed in the sampling area.
- **Sediment Characteristics:** Note the grain size, color, consistency, layering, presence of biological organisms, man-made debris, etc. in accordance with standard ASTM soil description protocols.
- **Sediment Deposits**: Note those deposits described (or include any other deposits not listed) which are present in the sampling area. Also indicate whether the undersides of rocks not deeply embedded are black (which generally indicates low dissolved oxygen or anaerobic conditions).

References

For additional information pertaining to this topic, the user of this manual may reference the following:

ASTM D5358	Practice for Sampling with a Dipper or Pond Sampler
ASTM D4489	Practices for Sampling of Waterborne Oils
ASTM D3325	Practice for the Preservation of Waterborne Oil Samples
ASTM D4841	Practice for Estimation of Holding Time for Water Samples Containing Organic and Inorganic Constituents
ASTM D4416	Guide for Sampling Fluvial Sediment in Motion
ASTM D4823	Guide for Core-Sampling Submerged, Unconsolidated Sediments
ASTM D3213	Practice for Handling, Storing, and Preparing Soft Undisturbed Marine Soil
ASTM D3976	Practice for Preparation of Sediment Samples for Chemical Analysis
ASTM E1391	Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing
ASTM D4581	Guide for Measurement of Morphologic Characteristics of Surface Water Bodies
ASTM D5906	Guide for Measuring Horizontal Positioning During Measurements of Surface Water Depths
ASTM D5073	Practice for Depth Measurement of Surface Water
ASTM D5413	Test Methods for Measurement of Water Levels in Open-Water Bodies

Appendix D
Soil Boring Logs

Project Name: Marcus Hook AOI 6

STRATIGRAPHY LOG (OVERBURDEN)

Project Number: 11109679
Client: Evergreen
Location:

Drilling Contractor Sweeney
Driller:
Drilling Method: Backhoe
Surface Elevation:

Hole Designation: BH-16-005
Date/Time Started: 4/22/16 11:30
Date Completed: 4/22/2016
GHD Supervisor: Matthew Marcus

LITHOLOGY	Stratigraphic Intervals (depths in ft bgs) FROM	AT	TO	SAMPLE DESCRIPTION Order of Descriptors: Primary Component/Secondary Components Relative Density/Consistency, Grain Size/Plasticity, Gradation/Structure, Color, Moisture Content, Supplementary Descriptors	SAMPLE DETAILS: SAMPLE #	SAMPLING METHOD	Penetration Record Split Spoon Blows 6"	6"	6"	6"	RECOVERY	INTERVAL	PID (ppm)	N-VALUE
	0		2	Dark brown silty sand fill with pebbles and brick pieces. Some cobbles. No odor/stain									3.5	
	2		4	Same, with staining and light odor. Plastic liner at 3'									9	
	4		6	Sandy silty sill, with pebbles and gravel. Dark brown, some staining, light odor. Moist									3	
	6		8	Gravelly rocky fill, some silt and clayh, heavy staining. Moist									9.9	
	8		10	Same. Fill material									16.7	
	10		12	Moist to wet. More clay, grayish, gravelly fill as above staining. Wood debris. Ground water not encountered									23.7	

Notes and Comments

HA - Hand Auger
NA - Not Available
WH - Weight of Hammer

SS - Split-Spoon
NIR: No Instrument Response.

Project Name: Marcus Hook AOI 6

STRATIGRAPHY LOG (OVERBURDEN)

Project Number: 11109679
Client: Evergreen
Location:

Drilling Contractor Sweeney
Driller:
Drilling Method: Backhoe
Surface Elevation:

Hole Designation: BH-16-006
Date/Time Started: 4/22/16 12:13
Date Completed: 4/22/2016
GHD Supervisor: Matthew Marcus

LITHOLOGY	Stratigraphic Intervals (depths in ft bgs) FROM	AT	TO	SAMPLE DESCRIPTION Order of Descriptors: Primary Component/Secondary Components Relative Density/Consistency, Grain Size/Plasticity, Gradation/Structure, Color, Moisture Content, Supplementary Descriptors	SAMPLE DETAILS SAMPLE #	SAMPLING METHOD	Penetration Record Split Spoon Blows 6"	6"	6"	6"	RECOVERY	INTERVAL SAMPLE	PID (ppm)	N-VALUE
	0		2	Sandy silt, with fill, pebbles, plastic debris, cobbles, moist. Light brown with some black staining, odor									7.6	
	2		4	Same as above									6.7	
	4		6	Gravelly fill with some silts/sands. Heavy black stain with odor. Moist									5.9	
	6		8	Fill, same as above									17.7	
	8		10	Fill, debris, black stained, strong odor									15.9	
	10		12	Heavily black stained, strong odor, all fill material. Well graded; Grains of all sizes. Some clay/silts, some large cobbles. Moist									32.3	

Notes and Comments

HA - Hand Auger
NA - Not Available
WH - Weight of Hammer

SS - Split-Spoon
NIR: No Instrument Response.

Project Name: Marcus Hook AOI 6

STRATIGRAPHY LOG (OVERBURDEN)

Project Number: 11109679
Client: Evergreen
Location:

Drilling Contractor Sweeney
Driller:
Drilling Method: Backhoe
Surface Elevation:

Hole Designation: BH-16-007
Date/Time Started: 4/22/16 13:00
Date Completed: 4/22/2016
GHD Supervisor: Matthew Marcus

LITHOLOGY	Stratigraphic Intervals (depths in ft bgs) FROM	AT	TO	SAMPLE DESCRIPTION Order of Descriptors: Primary Component/Secondary Components Relative Density/Consistency, Grain Size/Plasticity, Gradation/Structure, Color, Moisture Content, Supplementary Descriptors	SAMPLE DETAILS: SAMPLE #	SAMPLING METHOD	Penetration Record Split Spoon Blows 6"	6"	6"	6"	RECOVERY	INSTAR SAMPLE VAL	PID (ppm)	N-VALUE
	0		2	Clayey silt.,light brown with orangish flecks. Some sands and gravels throughout. Some staining, moist									3.2	
	2		4	Gray clay layer, then oily gravelly fill below. Odor and staining									53.6	
	4		6	Dark brown, silty gravelly fill, heavily stained black. Strong odor, moist to wet. Brick pieces.									25	
	6		7.5	Wet, oily gravelly fill. Very coarse, black stained with strong odor										

Notes and Comments

HA - Hand Auger
NA - Not Available
WH - Weight of Hammer

SS - Split-Spoon
NIR: No Instrument Response.

Aquaterra
Technologies, Inc.

MONITORING WELL LOG: MW-304

PROJECT:	Sunoco- Marcus Hook Refinery	DRILLING CO.:	Parratt Wolff
SITE LOCATION:	AOI-6	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:		SAMPLING METHOD:	Split Spoon
LOGGED BY:	Noelle Stroik	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	26 April 2012	WELLBORE DIAMETER:	10.25
TOTAL DEPTH:	20'	ELEVATION:	ELEVATION

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0				4' Well Stick Up		
	5.6		Black/Brown GRAVEL, little clayey silt and fine to coarse sand, dry to moist, no odor.	Sample taken at 0 to 1' bgs	PVC Riser 0 to 1' bgs	
					PVC Slot 0.020 Screen 1' to 7' bgs	
				Cleared down to 10 feet bgs	Sand Pack from 0' to 8' bgs	
-5			FILL: Gravel. Could not grab sample.			
				Water/Product Encountered at 7 feet bgs		
-10	3.0		Brown silty CLAY, trace to little fine to medium sand, moist, no odor.	Sample (spoon) taken 10-12'		
	2.8		Brown GRAVEL, some to little fine to medium sand, wet. no odor.			
	0.4		Same as above.			
-15						
	0.2		Brown gravelly fine to medium SAND, trace to little silt, wet, no odor			
			No Recovery, rock in shoe.			
-20				Borring terminated at 20 feet bgs		

Aquaterra
Technologies, Inc.

MONITORING WELL LOG: MW-305

PROJECT:	Sunoco- Marcus Hook Refinery	DRILLING CO.:	Parratt Wolff
SITE LOCATION:	AOI-6	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:		SAMPLING METHOD:	Split Spoon
LOGGED BY:	Noelle Stroik	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	26 April 2012	WELLBORE DIAMETER:	10.25
TOTAL DEPTH:	20'	ELEVATION:	ELEVATION

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0				4' Well Stick Up	PVC Riser 0 to 5' bgs	
	7.4		Black/Brown GRAVEL, little to some silt and fine to medium sand, moist, slight odor.	Sample taken at 1.5 to 2' bgs		
			Black/Brown GRAVEL, little clay, little silt, moist, no odor.		Bentonite from 1.5' to 3' bgs.	
				Cleared down to 10 feet bgs	Sand Pack from 3' to 20' bgs	
-5			FILL: Concrete and Gravel. Could not grab sample.			
	4.2		Brown CLAY, some to little silt, and gravel, wet, no odor.	Sample taken at 8 to 9' bgs.		
				Water Encountered at 9 feet bgs		
-10	11.2		Brown clayey silt, trace to little fine to medium sand, wet, no odor.		PVC Slot 0.020 Screen 5' to 20' bgs	
	77.2		Brown gravelly fine to coarse sand, little to trace silt, wet, odor.			
	1.3		Green/Brown/Pink gravelly fine to coarse sand, little to trace silt, wet, no odor.			
-15						
	1.1		Same as above.			
	1.1		Same as above.			
				Borring terminated at 20 feet bgs		
-20						

Aquaterra Technologies, Inc

MONITORING WELL LOG: MW-313

PROJECT:	Sunoco- Marcus Hook Refinery	DRILLING CO.:	Parratt Wolff
SITE LOCATION:	AOI-6	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:		SAMPLING METHOD:	Split Spoon
LOGGED BY:	Noelle Stroik	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	24 April 2012	WELLBORE DIAMETER:	10.25
TOTAL DEPTH:	14'	ELEVATION:	ELEVATION

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0				4' Well Stick Up		
	7.7		Brown GRAVEL, little to some silt, little fine to medium sand, dry, no odor.	Sample taken at 0 to 2' bgs	PVC Riser 0 to 2' bgs	
			Fill: Bricks, Fire Bricks, Boulders, Gravel.		Bentonite from 1' to 1.5' bgs.	
				Cleared down to 10 feet bgs	Sand Pack from 1.5' to 14' bgs	
-5			Not enough fines to collect lab sample.			
				Water/Product Encountered at 6 feet bgs	PVC Slot 0.020 Screen 2' to 14' bgs	
-10			No Recovery.	Not enough recovrey to get sample w/ spoon.		
	25.6		Dark Brown silty fine to coarse SAND, wet, slight odor.			
				Borring terminated at 14 feet bgs		

Appendix E
Soil Laboratory Analytical Report

eurofins | Lancaster Laboratories Environmental

2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-2681 • www.LancasterLabs.com

Analysis Report

REVISED

ANALYTICAL RESULTS

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

Report Date: June 21, 2016

Project: Marcus Hook Facility

Submittal Date: 04/22/2016
Group Number: 1653595
SDG: MHF31
PO Number: 34004491
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LL) #
BH-16-005-0-2-Soil Grab Soil	8347275
BH-16-005-10-11-Soil Grab Soil	8347276
BH-16-006-0-2-Soil Grab Soil	8347277
BH-16-006-10-12-Soil Grab Soil	8347278
BH-16-007-0-2-Soil Grab Soil	8347279
BH-16-007-6-7.5-Soil Grab Soil	8347280
BH-16-009-0-2-Soil Grab Soil	8347281
BH-16-009-5.5-8-Soil Grab Soil	8347282
BH-16-008-0-2-Soil Grab Soil	8347283
BH-16-011-0-2-Soil Grab Soil	8347284
BH-16-011-4-5-Soil Grab Soil	8347285

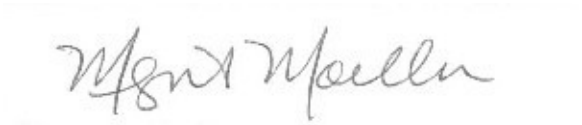
The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Regulatory agencies do not accredit laboratories for all methods, analytes, and matrices. Our scopes of accreditation can be viewed at http://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/ .

Electronic Copy To	GHD, Inc.	Attn: Arlie Weigley
Electronic Copy To	GHD, Inc.	Attn: Dave Steele
Electronic Copy To	GHD	Attn: Paul McMahon

REVISED

Respectfully Submitted,



Megan A. Moeller
Senior Specialist

(717) 556-7261

REVISED

Sample Description: BH-16-005-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347275
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 11:35 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3101 SDG#: MHF31-01

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**	**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	N.D.	6	0.6	0.96
10237	1,2-Dibromoethane	106-93-4	N.D.	6	1	0.96
10237	1,2-Dichloroethane	107-06-2	N.D.	6	1	0.96
10237	Ethylbenzene	100-41-4	N.D.	6	1	0.96
10237	Isopropylbenzene	98-82-8	N.D.	6	1	0.96
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	6	0.6	0.96
10237	Toluene	108-88-3	N.D.	6	1	0.96
10237	1,2,4-Trimethylbenzene	95-63-6	N.D.	6	1	0.96
10237	1,3,5-Trimethylbenzene	108-67-8	N.D.	6	1	0.96
10237	Xylene (Total)	1330-20-7	N.D.	6	1	0.96
GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**	**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	1,000	40	8	2
10727	Benzo(a)anthracene	56-55-3	3,600	40	8	2
10727	Benzo(a)pyrene	50-32-8	3,000	40	8	2
10727	Benzo(b)fluoranthene	205-99-2	3,600	40	8	2
10727	Benzo(g,h,i)perylene	191-24-2	1,700	40	8	2
10727	Chrysene	218-01-9	3,400	40	8	2
10727	Fluorene	86-73-7	330	40	8	2
10727	Naphthalene	91-20-3	150	40	8	2
10727	Phenanthrene	85-01-8	3,300	40	8	2
10727	Pyrene	129-00-0	5,800	40	8	2
Metals	**SW-846 6010B**		**mg/kg**	**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	85.3	1.32	0.448	1
	SW-846 7471A		**mg/kg**	**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	0.492	0.117	0.0117	1
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**	**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	10.8 J	0.0100	0.0100	1
	The pH was measured in water at 21.1 C.					
Wet Chemistry	**SM 2540 G-1997**		**%**	**%**	**%**	
00111	Moisture	n.a.	15.6	0.50	0.50	1
	Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.					

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-005-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347275
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 11:35 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3101 SDG#: MHF31-01

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	X161231AA	05/02/2016 12:20	Jennifer K Howe	0.96
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 11:35	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 11:35	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 11:35	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 11:44	Linda M Hartenstine	2
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:02	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 12:30	Damary Valentin	1
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039401B	04/28/2016 20:20	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-005-10-11-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347276
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 12:00 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3102 SDG#: MHF31-02

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**		**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	N.D.		16,000	1,600	2553.71
10237	1,2-Dibromoethane	106-93-4	N.D.		16,000	3,100	2553.71
10237	1,2-Dichloroethane	107-06-2	N.D.		16,000	3,100	2553.71
10237	Ethylbenzene	100-41-4	N.D.		16,000	3,100	2553.71
10237	Isopropylbenzene	98-82-8	11,000	J	16,000	3,100	2553.71
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		16,000	1,600	2553.71
10237	Toluene	108-88-3	N.D.		16,000	3,100	2553.71
10237	1,2,4-Trimethylbenzene	95-63-6	N.D.		16,000	3,100	2553.71
10237	1,3,5-Trimethylbenzene	108-67-8	N.D.		16,000	3,100	2553.71
10237	Xylene (Total)	1330-20-7	N.D.		16,000	3,100	2553.71
Reporting limits were raised due to sample foaming.							
GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**		**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	5,000		420	81	2
10727	Benzo(a)anthracene	56-55-3	19,000		420	81	2
10727	Benzo(a)pyrene	50-32-8	9,900		420	81	2
10727	Benzo(b)fluoranthene	205-99-2	10,000		420	81	2
10727	Benzo(g,h,i)perylene	191-24-2	3,900		420	81	2
10727	Chrysene	218-01-9	38,000		420	81	2
10727	Fluorene	86-73-7	3,300		420	81	2
10727	Naphthalene	91-20-3	3,100		420	81	2
10727	Phenanthrene	85-01-8	28,000		420	81	2
10727	Pyrene	129-00-0	25,000		420	81	2
Reporting limits were raised due to interference from the sample matrix.							
Metals	**SW-846 6010B**		**mg/kg**		**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	325		1.61	0.549	1
	SW-846 7471A		**mg/kg**		**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	2.53		1.21	0.121	10
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**		**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	2.59	J	0.0100	0.0100	1
The pH was measured in water at 20.9 C.							
Wet Chemistry	**SM 2540 G-1997**		**%**		**%**	**%**	
00111	Moisture	n.a.	18.5		0.50	0.50	1
Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.							

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-005-10-11-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347276
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 12:00 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3102 SDG#: MHF31-02

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	Q161211AA	04/30/2016 15:29	Anita M Dale	2553.71
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 12:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 12:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 12:00	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 12:05	Linda M Hartenstine	2
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:06	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 13:04	Damary Valentin	10
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039401B	04/28/2016 20:20	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-006-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347277
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 12:15 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3103 SDG#: MHF31-03

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**		**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	7		6	0.6	0.86
10237	1,2-Dibromoethane	106-93-4	N.D.		6	1	0.86
10237	1,2-Dichloroethane	107-06-2	N.D.		6	1	0.86
10237	Ethylbenzene	100-41-4	7		6	1	0.86
10237	Isopropylbenzene	98-82-8	5	J	6	1	0.86
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		6	0.6	0.86
10237	Toluene	108-88-3	16		6	1	0.86
10237	1,2,4-Trimethylbenzene	95-63-6	96		6	1	0.86
10237	1,3,5-Trimethylbenzene	108-67-8	33		6	1	0.86
10237	Xylene (Total)	1330-20-7	53		6	1	0.86

The recovery for the sample internal standard is outside the QC acceptance limits. The following corrective action was taken: The sample was re-analyzed and the QC is again outside of the acceptance limits, indicating a matrix effect. The data is reported from the initial trial.

GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**		**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	1,900		220	43	2
10727	Benzo(a)anthracene	56-55-3	6,900		220	43	2
10727	Benzo(a)pyrene	50-32-8	3,100		220	43	2
10727	Benzo(b)fluoranthene	205-99-2	4,600		220	43	2
10727	Benzo(g,h,i)perylene	191-24-2	1,800		220	43	2
10727	Chrysene	218-01-9	17,000		220	43	2
10727	Fluorene	86-73-7	1,700		220	43	2
10727	Naphthalene	91-20-3	1,900		220	43	2
10727	Phenanthrene	85-01-8	11,000		220	43	2
10727	Pyrene	129-00-0	9,600		220	43	2

Reporting limits were raised due to interference from the sample matrix.

Metals	**SW-846 6010B**		**mg/kg**		**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	264		1.31	0.445	1
	SW-846 7471A		**mg/kg**		**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	11.4		3.23	0.323	25
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**		**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	5.44		0.0100	0.0100	1

The pH was measured in water at 21 C.

Wet Chemistry	**SM 2540 G-1997**		**%**		**%**	**%**	
00111	Moisture	n.a.	22.6		0.50	0.50	1

Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-006-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347277
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 12:15 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3103 SDG#: MHF31-03

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	X161201AA	04/29/2016 17:51	Jennifer K Howe	0.86
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 12:15	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 12:15	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 12:15	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 12:25	Linda M Hartenstine	2
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:10	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 13:06	Damary Valentin	25
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039401B	04/28/2016 20:20	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-006-10-12-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347278
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 12:40 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3104 SDG#: MHF31-04

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**	**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	N.D.	19,000	1,900	3292.81
10237	1,2-Dibromoethane	106-93-4	N.D.	19,000	3,900	3292.81
10237	1,2-Dichloroethane	107-06-2	N.D.	19,000	3,900	3292.81
10237	Ethylbenzene	100-41-4	N.D.	19,000	3,900	3292.81
10237	Isopropylbenzene	98-82-8	N.D.	19,000	3,900	3292.81
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	19,000	1,900	3292.81
10237	Toluene	108-88-3	N.D.	19,000	3,900	3292.81
10237	1,2,4-Trimethylbenzene	95-63-6	N.D.	19,000	3,900	3292.81
10237	1,3,5-Trimethylbenzene	108-67-8	N.D.	19,000	3,900	3292.81
10237	Xylene (Total)	1330-20-7	N.D.	19,000	3,900	3292.81
	Reporting limits were raised due to sample foaming.					
GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**	**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	5,600	390	77	2
10727	Benzo(a)anthracene	56-55-3	14,000	390	77	2
10727	Benzo(a)pyrene	50-32-8	11,000	390	77	2
10727	Benzo(b)fluoranthene	205-99-2	8,500	390	77	2
10727	Benzo(g,h,i)perylene	191-24-2	3,800	390	77	2
10727	Chrysene	218-01-9	33,000	390	77	2
10727	Fluorene	86-73-7	3,600	390	77	2
10727	Naphthalene	91-20-3	1,000	390	77	2
10727	Phenanthrene	85-01-8	47,000	390	77	2
10727	Pyrene	129-00-0	40,000	390	77	2
	Reporting limits were raised due to interference from the sample matrix.					
Metals	**SW-846 6010B**		**mg/kg**	**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	616	1.43	0.487	1
	SW-846 7471A		**mg/kg**	**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	1.33	0.578	0.0578	5
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**	**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	0.680 J	0.0100	0.0100	1
	The pH was measured in water at 21.1 C.					
Wet Chemistry	**SM 2540 G-1997**		**%**	**%**	**%**	
00111	Moisture	n.a.	14.9	0.50	0.50	1
	Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.					

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-006-10-12-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347278
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 12:40 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3104 SDG#: MHF31-04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	Q161201AA	04/29/2016 14:48	Anita M Dale	3292.81
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 12:40	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 12:40	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 12:40	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 12:46	Linda M Hartenstine	2
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:14	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 13:08	Damary Valentin	5
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039401B	04/28/2016 20:20	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-007-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347279
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 13:05 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3105 SDG#: MHF31-05

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**	**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	N.D.	240	24	42.35
10237	1,2-Dibromoethane	106-93-4	N.D.	240	49	42.35
10237	1,2-Dichloroethane	107-06-2	N.D.	240	49	42.35
10237	Ethylbenzene	100-41-4	N.D.	240	49	42.35
10237	Isopropylbenzene	98-82-8	N.D.	240	49	42.35
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	240	24	42.35
10237	Toluene	108-88-3	N.D.	240	49	42.35
10237	1,2,4-Trimethylbenzene	95-63-6	N.D.	240	49	42.35
10237	1,3,5-Trimethylbenzene	108-67-8	N.D.	240	49	42.35
10237	Xylene (Total)	1330-20-7	N.D.	240	49	42.35
GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**	**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	320	39	8	2
10727	Benzo(a)anthracene	56-55-3	450	39	8	2
10727	Benzo(a)pyrene	50-32-8	340	39	8	2
10727	Benzo(b)fluoranthene	205-99-2	190	39	8	2
10727	Benzo(g,h,i)perylene	191-24-2	290	39	8	2
10727	Chrysene	218-01-9	860	39	8	2
10727	Fluorene	86-73-7	700	39	8	2
10727	Naphthalene	91-20-3	190	39	8	2
10727	Phenanthrene	85-01-8	1,200	39	8	2
10727	Pyrene	129-00-0	1,600	39	8	2
Metals	**SW-846 6010B**		**mg/kg**	**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	72.1	1.29	0.439	1
	SW-846 7471A		**mg/kg**	**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	0.817	0.114	0.0114	1
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**	**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	7.29	0.0100	0.0100	1
	The pH was measured in water at 20.8 C.					
Wet Chemistry	**SM 2540 G-1997**		**%**	**%**	**%**	
00111	Moisture	n.a.	13.4	0.50	0.50	1
	Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.					

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-007-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347279
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 13:05 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3105 SDG#: MHF31-05

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	Q161201AA	04/29/2016 09:29	Anita M Dale	42.35
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 13:05	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 13:05	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 13:05	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 13:06	Linda M Hartenstine	2
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:18	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 12:38	Damary Valentin	1
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039401B	04/28/2016 20:20	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-007-6-7.5-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347280
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 13:20 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3106 SDG#: MHF31-06

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**		**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	N.D.		7	0.7	1.14
10237	1,2-Dibromoethane	106-93-4	N.D.		7	1	1.14
10237	1,2-Dichloroethane	107-06-2	N.D.		7	1	1.14
10237	Ethylbenzene	100-41-4	N.D.		7	1	1.14
10237	Isopropylbenzene	98-82-8	4	J	7	1	1.14
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		7	0.7	1.14
10237	Toluene	108-88-3	N.D.		7	1	1.14
10237	1,2,4-Trimethylbenzene	95-63-6	6	J	7	1	1.14
10237	1,3,5-Trimethylbenzene	108-67-8	N.D.		7	1	1.14
10237	Xylene (Total)	1330-20-7	N.D.		7	1	1.14

The recovery for the sample internal standard is outside the QC acceptance limits. The following corrective action was taken: The sample was re-analyzed and the QC is again outside of the acceptance limits, indicating a matrix effect. The data is reported from the initial trial.

GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**		**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	520		41	8	2
10727	Benzo(a)anthracene	56-55-3	880		41	8	2
10727	Benzo(a)pyrene	50-32-8	430		41	8	2
10727	Benzo(b)fluoranthene	205-99-2	480		41	8	2
10727	Benzo(g,h,i)perylene	191-24-2	370		41	8	2
10727	Chrysene	218-01-9	1,500		41	8	2
10727	Fluorene	86-73-7	1,200		41	8	2
10727	Naphthalene	91-20-3	1,500		41	8	2
10727	Phenanthrene	85-01-8	3,400		41	8	2
10727	Pyrene	129-00-0	1,600		41	8	2
Metals	**SW-846 6010B**		**mg/kg**		**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	100		1.26	0.427	1
	SW-846 7471A		**mg/kg**		**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	2.04		1.19	0.119	10
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**		**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	7.32		0.0100	0.0100	1

The pH was measured in water at 21 C.

Wet Chemistry	**SM 2540 G-1997**		**%**		**%**	**%**	
00111	Moisture	n.a.	18.7		0.50	0.50	1

Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-007-6-7.5-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347280
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 13:20 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3106 SDG#: MHF31-06

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	X161201AA	04/29/2016 18:14	Jennifer K Howe	1.14
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 13:20	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 13:20	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 13:20	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 13:27	Linda M Hartenstine	2
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:22	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 13:14	Damary Valentin	10
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039401B	04/28/2016 20:20	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-009-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347281
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 11:10 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3107 SDG#: MHF31-07

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**		**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	920	J	1,500	150	245.13
10237	1,2-Dibromoethane	106-93-4	N.D.		1,500	300	245.13
10237	1,2-Dichloroethane	107-06-2	N.D.		1,500	300	245.13
10237	Ethylbenzene	100-41-4	N.D.		1,500	300	245.13
10237	Isopropylbenzene	98-82-8	540	J	1,500	300	245.13
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		1,500	150	245.13
10237	Toluene	108-88-3	1,300	J	1,500	300	245.13
10237	1,2,4-Trimethylbenzene	95-63-6	1,000	J	1,500	300	245.13
10237	1,3,5-Trimethylbenzene	108-67-8	N.D.		1,500	300	245.13
10237	Xylene (Total)	1330-20-7	630	J	1,500	300	245.13
GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**		**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	1,300		210	40	2
10727	Benzo(a)anthracene	56-55-3	1,500		210	40	2
10727	Benzo(a)pyrene	50-32-8	1,000		210	40	2
10727	Benzo(b)fluoranthene	205-99-2	1,400		210	40	2
10727	Benzo(g,h,i)perylene	191-24-2	850		210	40	2
10727	Chrysene	218-01-9	3,700		210	40	2
10727	Fluorene	86-73-7	2,000		210	40	2
10727	Naphthalene	91-20-3	1,500		210	40	2
10727	Phenanthrene	85-01-8	4,400		210	40	2
10727	Pyrene	129-00-0	6,800		210	40	2
	Reporting limits were raised due to interference from the sample matrix.						
Metals	**SW-846 6010B**		**mg/kg**		**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	179		1.77	0.600	1
	SW-846 7471A		**mg/kg**		**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	0.250		0.112	0.0112	1
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**		**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	6.94		0.0100	0.0100	1
	The pH was measured in water at 20.9 C.						
Wet Chemistry	**SM 2540 G-1997**		**%**		**%**	**%**	
00111	Moisture	n.a.	17.5		0.50	0.50	1
	Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.						

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-009-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347281
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 11:10 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3107 SDG#: MHF31-07

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	Q161201AA	04/29/2016 16:41	Anita M Dale	245.13
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 11:10	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 11:10	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 11:10	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 13:48	Linda M Hartenstine	2
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:25	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 12:49	Damary Valentin	1
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039402A	04/28/2016 21:15	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-009-5.5-8-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347282
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 11:20 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3108 SDG#: MHF31-08

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**		**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	120	J	310	31	54.7
10237	1,2-Dibromoethane	106-93-4	N.D.		310	61	54.7
10237	1,2-Dichloroethane	107-06-2	N.D.		310	61	54.7
10237	Ethylbenzene	100-41-4	N.D.		310	61	54.7
10237	Isopropylbenzene	98-82-8	N.D.		310	61	54.7
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		310	31	54.7
10237	Toluene	108-88-3	140	J	310	61	54.7
10237	1,2,4-Trimethylbenzene	95-63-6	74	J	310	61	54.7
10237	1,3,5-Trimethylbenzene	108-67-8	N.D.		310	61	54.7
10237	Xylene (Total)	1330-20-7	180	J	310	61	54.7
	Reporting limits were raised due to interference from the sample matrix.						
GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**		**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	670		38	7	2
10727	Benzo(a)anthracene	56-55-3	620		38	7	2
10727	Benzo(a)pyrene	50-32-8	440		38	7	2
10727	Benzo(b)fluoranthene	205-99-2	510		38	7	2
10727	Benzo(g,h,i)perylene	191-24-2	370		38	7	2
10727	Chrysene	218-01-9	1,300		38	7	2
10727	Fluorene	86-73-7	800		38	7	2
10727	Naphthalene	91-20-3	780		38	7	2
10727	Phenanthrene	85-01-8	1,400		38	7	2
10727	Pyrene	129-00-0	2,300		38	7	2
Metals	**SW-846 6010B**		**mg/kg**		**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	74.5		1.43	0.486	1
	SW-846 7471A		**mg/kg**		**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	0.237		0.110	0.0110	1
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**		**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	8.08		0.0100	0.0100	1
	The pH was measured in water at 20.9 C.						
Wet Chemistry	**SM 2540 G-1997**		**%**		**%**	**%**	
00111	Moisture	n.a.	10.4		0.50	0.50	1
	Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.						

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-009-5.5-8-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347282
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 11:20 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3108 SDG#: MHF31-08

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	Q161231AA	05/02/2016 12:54	Anita M Dale	54.7
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 11:20	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 11:20	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 11:20	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 14:08	Linda M Hartenstine	2
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:29	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 12:51	Damary Valentin	1
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039402A	04/28/2016 21:15	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-008-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347283
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 10:00 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3109 SDG#: MHF31-09

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**		**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	680	J	1,200	120	193.41
10237	1,2-Dibromoethane	106-93-4	N.D.		1,200	230	193.41
10237	1,2-Dichloroethane	107-06-2	N.D.		1,200	230	193.41
10237	Ethylbenzene	100-41-4	N.D.		1,200	230	193.41
10237	Isopropylbenzene	98-82-8	460	J	1,200	230	193.41
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		1,200	120	193.41
10237	Toluene	108-88-3	N.D.		1,200	230	193.41
10237	1,2,4-Trimethylbenzene	95-63-6	N.D.		1,200	230	193.41
10237	1,3,5-Trimethylbenzene	108-67-8	N.D.		1,200	230	193.41
10237	Xylene (Total)	1330-20-7	N.D.		1,200	230	193.41
	Reporting limits were raised due to interference from the sample matrix.						
GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**		**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	470		200	40	10
10727	Benzo(a)anthracene	56-55-3	520		200	40	10
10727	Benzo(a)pyrene	50-32-8	520		200	40	10
10727	Benzo(b)fluoranthene	205-99-2	410		200	40	10
10727	Benzo(g,h,i)perylene	191-24-2	420		200	40	10
10727	Chrysene	218-01-9	1,100		200	40	10
10727	Fluorene	86-73-7	990		200	40	10
10727	Naphthalene	91-20-3	2,100		200	40	10
10727	Phenanthrene	85-01-8	1,500		200	40	10
10727	Pyrene	129-00-0	1,600		200	40	10
Metals	**SW-846 6010B**		**mg/kg**		**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	106		1.71	0.583	1
	SW-846 7471A		**mg/kg**		**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	0.796		0.111	0.0111	1
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**		**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	7.97		0.0100	0.0100	1
	The pH was measured in water at 20 C.						
Wet Chemistry	**SM 2540 G-1997**		**%**		**%**	**%**	
00111	Moisture	n.a.	16.7		0.50	0.50	1
	Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.						

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-008-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347283
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 10:00 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3109 SDG#: MHF31-09

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	Q161211AA	04/30/2016 14:44	Anita M Dale	193.41
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 10:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 10:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 10:00	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 17:49	William H Saadeh	10
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:41	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 12:54	Damary Valentin	1
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039402A	04/28/2016 21:15	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-011-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347284
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 09:00 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3110 SDG#: MHF31-10

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**		**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	3	J	4	0.4	0.68
10237	1,2-Dibromoethane	106-93-4	N.D.		4	0.9	0.68
10237	1,2-Dichloroethane	107-06-2	N.D.		4	0.9	0.68
10237	Ethylbenzene	100-41-4	N.D.		4	0.9	0.68
10237	Isopropylbenzene	98-82-8	N.D.		4	0.9	0.68
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		4	0.4	0.68
10237	Toluene	108-88-3	N.D.		4	0.9	0.68
10237	1,2,4-Trimethylbenzene	95-63-6	N.D.		4	0.9	0.68
10237	1,3,5-Trimethylbenzene	108-67-8	N.D.		4	0.9	0.68
10237	Xylene (Total)	1330-20-7	1	J	4	0.9	0.68
GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**		**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	2,300		21	4	1
10727	Benzo(a)anthracene	56-55-3	3,700		21	4	1
10727	Benzo(a)pyrene	50-32-8	2,500		21	4	1
10727	Benzo(b)fluoranthene	205-99-2	4,300		21	4	1
10727	Benzo(g,h,i)perylene	191-24-2	1,500		21	4	1
10727	Chrysene	218-01-9	4,000		21	4	1
10727	Fluorene	86-73-7	770		21	4	1
10727	Naphthalene	91-20-3	220		21	4	1
10727	Phenanthrene	85-01-8	5,600		110	21	5
10727	Pyrene	129-00-0	8,100		110	21	5
Metals	**SW-846 6010B**		**mg/kg**		**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	101		1.28	0.434	1
	SW-846 7471A		**mg/kg**		**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	0.156		0.118	0.0118	1
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**		**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	7.73		0.0100	0.0100	1
	The pH was measured in water at 20.3 C.						
Wet Chemistry	**SM 2540 G-1997**		**%**		**%**	**%**	
00111	Moisture	n.a.	21.6		0.50	0.50	1
	Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.						

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-011-0-2-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347284
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 09:00 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3110 SDG#: MHF31-10

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	X161201AA	04/29/2016 16:19	Jennifer K Howe	0.68
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 09:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 09:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 09:00	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 14:50	Linda M Hartenstine	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 18:09	William H Saadeh	5
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:45	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 12:56	Damary Valentin	1
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039402A	04/28/2016 21:15	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-011-4-5-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347285
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 09:35 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3111 SDG#: MHF31-11

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**	**ug/kg**	**ug/kg**	
10237	Benzene	71-43-2	N.D.	5	0.5	0.77
10237	1,2-Dibromoethane	106-93-4	N.D.	5	0.9	0.77
10237	1,2-Dichloroethane	107-06-2	N.D.	5	0.9	0.77
10237	Ethylbenzene	100-41-4	10	5	0.9	0.77
10237	Isopropylbenzene	98-82-8	N.D.	5	0.9	0.77
10237	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	5	0.5	0.77
10237	Toluene	108-88-3	N.D.	5	0.9	0.77
10237	1,2,4-Trimethylbenzene	95-63-6	N.D.	5	0.9	0.77
10237	1,3,5-Trimethylbenzene	108-67-8	N.D.	5	0.9	0.77
10237	Xylene (Total)	1330-20-7	N.D.	5	0.9	0.77
GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**	**ug/kg**	**ug/kg**	
10727	Anthracene	120-12-7	71	20	4	1
10727	Benzo(a)anthracene	56-55-3	140	20	4	1
10727	Benzo(a)pyrene	50-32-8	110	20	4	1
10727	Benzo(b)fluoranthene	205-99-2	130	20	4	1
10727	Benzo(g,h,i)perylene	191-24-2	65	20	4	1
10727	Chrysene	218-01-9	300	20	4	1
10727	Fluorene	86-73-7	56	20	4	1
10727	Naphthalene	91-20-3	36	20	4	1
10727	Phenanthrene	85-01-8	430	20	4	1
10727	Pyrene	129-00-0	260	20	4	1
Metals	**SW-846 6010B**		**mg/kg**	**mg/kg**	**mg/kg**	
06955	Lead	7439-92-1	22.5	1.28	0.436	1
	SW-846 7471A		**mg/kg**	**mg/kg**	**mg/kg**	
00159	Mercury	7439-97-6	0.0985 J	0.119	0.0119	1
Wet Chemistry	**SW-846 9045D modified**		**Std. Units**	**Std. Units**	**Std. Units**	
00394	pH in soil	n.a.	8.04	0.0100	0.0100	1
	The pH was measured in water at 20.5 C.					
Wet Chemistry	**SM 2540 G-1997**		**%**	**%**	**%**	
00111	Moisture	n.a.	17.1	0.50	0.50	1
	Moisture represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported is on an as-received basis.					

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/17.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result

REVISED

Sample Description: BH-16-011-4-5-Soil Grab Soil
Marcus Hook AOI8

LL Sample # SW 8347285
LL Group # 1653595
Account # 10177

Project Name: Marcus Hook Facility

Collected: 04/22/2016 09:35 by MM

Submitted: 04/22/2016 18:25
Reported: 06/21/2016 12:55

Evergreen c/o GHD
2055 Niagara Falls Blvd.
Suite #3
Niagara Falls NY 14304

M3111 SDG#: MHF31-11

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10237	VOCs- Solid by 8260B	SW-846 8260B	1	X161201AA	04/29/2016 16:42	Jennifer K Howe	0.77
07579	GC/MS-5g Field Preserv.MeOH-NC	SW-846 5035A	1	201611440924	04/22/2016 09:35	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	1	201611440924	04/22/2016 09:35	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035A	2	201611440924	04/22/2016 09:35	Client Supplied	1
10727	TCL 8270 (microwave)	SW-846 8270C	1	16120SLA026	05/02/2016 15:10	Linda M Hartenstine	1
10809	BNA Soil Microwave	SW-846 3546	1	16120SLA026	04/29/2016 18:30	Sally L Appleyard	1
06955	Lead	SW-846 6010B	1	161185708002	04/30/2016 06:48	Matthew R Machtinger	1
00159	Mercury	SW-846 7471A	1	161205711002	05/02/2016 12:58	Damary Valentin	1
05708	ICP-ICPMS - SW, 3050B - U3	SW-846 3050B	1	161185708002	04/28/2016 23:11	Annamaria Kuhns	1
05711	Hg-SW, 7471A - U3	SW-846 7471A modified	1	161205711002	05/02/2016 09:40	Lisa J Cooke	1
00394	pH in soil	SW-846 9045D modified	1	16119039402A	04/28/2016 21:15	Luz M Groff	1
00111	Moisture	SM 2540 G-1997	1	16118820003A	04/27/2016 18:30	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

REVISED

Quality Control Summary

Client Name: Evergreen c/o GHD
Reported: 06/21/2016 12:55

Group Number: 1653595

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	LOQ**	MDL
	ug/kg	ug/kg	ug/kg
Batch number: Q161201AA	Sample number(s): 8347278-8347279,8347281		
Benzene	N.D.	250	25
1,2-Dibromoethane	N.D.	250	50
1,2-Dichloroethane	N.D.	250	50
Ethylbenzene	N.D.	250	50
Isopropylbenzene	N.D.	250	50
Methyl Tertiary Butyl Ether	N.D.	250	25
Toluene	N.D.	250	50
1,2,4-Trimethylbenzene	N.D.	250	50
1,3,5-Trimethylbenzene	N.D.	250	50
Xylene (Total)	N.D.	250	50
Batch number: Q161211AA	Sample number(s): 8347276,8347283		
Benzene	N.D.	250	25
1,2-Dibromoethane	N.D.	250	50
1,2-Dichloroethane	N.D.	250	50
Ethylbenzene	N.D.	250	50
Isopropylbenzene	N.D.	250	50
Methyl Tertiary Butyl Ether	N.D.	250	25
Toluene	N.D.	250	50
1,2,4-Trimethylbenzene	N.D.	250	50
1,3,5-Trimethylbenzene	N.D.	250	50
Xylene (Total)	N.D.	250	50
Batch number: Q161231AA	Sample number(s): 8347282		
Benzene	N.D.	250	25
1,2-Dibromoethane	N.D.	250	50
1,2-Dichloroethane	N.D.	250	50
Ethylbenzene	N.D.	250	50
Isopropylbenzene	N.D.	250	50
Methyl Tertiary Butyl Ether	N.D.	250	25
Toluene	N.D.	250	50
1,2,4-Trimethylbenzene	N.D.	250	50
1,3,5-Trimethylbenzene	N.D.	250	50
Xylene (Total)	N.D.	250	50
Batch number: X161201AA	Sample number(s): 8347277,8347280,8347284-8347285		
Benzene	N.D.	5	0.5
1,2-Dibromoethane	N.D.	5	1
1,2-Dichloroethane	N.D.	5	1
Ethylbenzene	N.D.	5	1
Isopropylbenzene	N.D.	5	1
Methyl Tertiary Butyl Ether	N.D.	5	0.5
Toluene	N.D.	5	1
1,2,4-Trimethylbenzene	N.D.	5	1

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
P###### is indicative of a Background or Unspiked sample that is batch matrix QC and was not performed using a sample from this submission group.

REVISED

Quality Control Summary

Client Name: Evergreen c/o GHD
Reported: 06/21/2016 12:55

Group Number: 1653595

Method Blank (continued)

Analysis Name	Result	LOQ**	MDL
	ug/kg	ug/kg	ug/kg
1,3,5-Trimethylbenzene	N.D.	5	1
Xylene (Total)	N.D.	5	1
Batch number: X161231AA	Sample number(s): 8347275		
Benzene	N.D.	5	0.5
1,2-Dibromoethane	N.D.	5	1
1,2-Dichloroethane	N.D.	5	1
Ethylbenzene	N.D.	5	1
Isopropylbenzene	N.D.	5	1
Methyl Tertiary Butyl Ether	N.D.	5	0.5
Toluene	N.D.	5	1
1,2,4-Trimethylbenzene	N.D.	5	1
1,3,5-Trimethylbenzene	N.D.	5	1
Xylene (Total)	N.D.	5	1
Batch number: 16120SLA026	Sample number(s): 8347275-8347285		
Anthracene	N.D.	17	3
Benzo(a)anthracene	N.D.	17	3
Benzo(a)pyrene	N.D.	17	3
Benzo(b)fluoranthene	N.D.	17	3
Benzo(g,h,i)perylene	N.D.	17	3
Chrysene	N.D.	17	3
Fluorene	N.D.	17	3
Naphthalene	N.D.	17	3
Phenanthrene	N.D.	17	3
Pyrene	N.D.	17	3
	mg/kg	mg/kg	mg/kg
Batch number: 161185708002	Sample number(s): 8347275-8347285		
Lead	N.D.	1.50	0.510
Batch number: 161205711002	Sample number(s): 8347275-8347285		
Mercury	N.D.	0.100	0.0100

LCS/LCSD

Analysis Name	LCS Spike Added	LCS Conc	LCSD Spike Added	LCSD Conc	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
	ug/kg	ug/kg	ug/kg	ug/kg					
Batch number: Q161201AA	Sample number(s): 8347278-8347279,8347281								
Benzene	1000	987.23	1000	958.42	99	96	80-120	3	30
1,2-Dibromoethane	1000	995.91	1000	963.44	100	96	80-120	3	30
1,2-Dichloroethane	1000	1004.11	1000	962.88	100	96	77-130	4	30
Ethylbenzene	1000	983.77	1000	947.07	98	95	80-120	4	30
Isopropylbenzene	1000	1005.28	1000	973.68	101	97	70-120	3	30
Methyl Tertiary Butyl Ether	1000	1000.9	1000	960.84	100	96	72-120	4	30
Toluene	1000	992.32	1000	961.3	99	96	80-120	3	30
1,2,4-Trimethylbenzene	1000	1003.1	1000	967.42	100	97	74-120	4	30
1,3,5-Trimethylbenzene	1000	1003.26	1000	975.14	100	98	73-120	3	30

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
P###### is indicative of a Background or Unspiked sample that is batch matrix QC and was not performed using a sample from this submission group.

REVISED

Quality Control Summary

Client Name: Evergreen c/o GHD
Reported: 06/21/2016 12:55

Group Number: 1653595

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/kg	LCS Conc ug/kg	LCSD Spike Added ug/kg	LCSD Conc ug/kg	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Xylene (Total)	3000	2971.07	3000	2829.99	99	94	80-120	5	30
Batch number: Q161211AA	Sample number(s): 8347276,8347283								
Benzene	1000	970.37	1000	975.51	97	98	80-120	1	30
1,2-Dibromoethane	1000	994.37	1000	960.74	99	96	80-120	3	30
1,2-Dichloroethane	1000	979.05	1000	973.1	98	97	77-130	1	30
Ethylbenzene	1000	953.94	1000	941.84	95	94	80-120	1	30
Isopropylbenzene	1000	993.71	1000	959.52	99	96	70-120	4	30
Methyl Tertiary Butyl Ether	1000	984.63	1000	974.29	98	97	72-120	1	30
Toluene	1000	995.97	1000	977.96	100	98	80-120	2	30
1,2,4-Trimethylbenzene	1000	991.95	1000	979.09	99	98	74-120	1	30
1,3,5-Trimethylbenzene	1000	992.04	1000	990.89	99	99	73-120	0	30
Xylene (Total)	3000	2890.55	3000	2859.01	96	95	80-120	1	30
Batch number: Q161231AA	Sample number(s): 8347282								
Benzene	1000	1036.58	1000	994.16	104	99	80-120	4	30
1,2-Dibromoethane	1000	1020.56	1000	955.81	102	96	80-120	7	30
1,2-Dichloroethane	1000	1018.01	1000	964.23	102	96	77-130	5	30
Ethylbenzene	1000	1004.12	1000	939.05	100	94	80-120	7	30
Isopropylbenzene	1000	1012.33	1000	948.5	101	95	70-120	7	30
Methyl Tertiary Butyl Ether	1000	1044.02	1000	979.92	104	98	72-120	6	30
Toluene	1000	1020.27	1000	971.57	102	97	80-120	5	30
1,2,4-Trimethylbenzene	1000	1044.92	1000	989.46	104	99	74-120	5	30
1,3,5-Trimethylbenzene	1000	1045.29	1000	995.92	105	100	73-120	5	30
Xylene (Total)	3000	2995.84	3000	2831.73	100	94	80-120	6	30
Batch number: X161201AA	Sample number(s): 8347277,8347280,8347284-8347285								
Benzene	20	19.82	20	20.06	99	100	80-120	1	30
1,2-Dibromoethane	20	18.68	20	18.31	93	92	80-120	2	30
1,2-Dichloroethane	20	22.43	20	22.06	112	110	77-130	2	30
Ethylbenzene	20	19.19	20	19.57	96	98	80-120	2	30
Isopropylbenzene	20	18.59	20	18.83	93	94	70-120	1	30
Methyl Tertiary Butyl Ether	20	18.26	20	18.12	91	91	72-120	1	30
Toluene	20	18.9	20	19.34	94	97	80-120	2	30
1,2,4-Trimethylbenzene	20	17.78	20	18.21	89	91	74-120	2	30
1,3,5-Trimethylbenzene	20	17.41	20	18.01	87	90	73-120	3	30
Xylene (Total)	60	55.08	60	55.83	92	93	80-120	1	30
Batch number: X161231AA	Sample number(s): 8347275								
Benzene	20	20.98	20	18.68	105	93	80-120	12	30
1,2-Dibromoethane	20	18.79	20	17.84	94	89	80-120	5	30
1,2-Dichloroethane	20	21.83	20	20.29	109	101	77-130	7	30
Ethylbenzene	20	20.23	20	18.08	101	90	80-120	11	30
Isopropylbenzene	20	19.54	20	17.35	98	87	70-120	12	30
Methyl Tertiary Butyl Ether	20	18.62	20	17.66	93	88	72-120	5	30
Toluene	20	20.26	20	18.11	101	91	80-120	11	30
1,2,4-Trimethylbenzene	20	18.7	20	16.91	94	85	74-120	10	30
1,3,5-Trimethylbenzene	20	18.55	20	16.69	93	83	73-120	11	30
Xylene (Total)	60	58.03	60	52.26	97	87	80-120	10	30
	ug/kg	ug/kg	ug/kg	ug/kg					

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
P###### is indicative of a Background or Unspiked sample that is batch matrix QC and was not performed using a sample from this submission group.

REVISED

Quality Control Summary

Client Name: Evergreen c/o GHD
Reported: 06/21/2016 12:55

Group Number: 1653595

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ug/kg	LCS Conc ug/kg	LCSD Spike Added ug/kg	LCSD Conc ug/kg	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 16120SLA026	Sample number(s): 8347275-8347285								
Anthracene	1666.67	1615.16			97		82-118		
Benzo(a)anthracene	1666.67	1516.41			91		76-119		
Benzo(a)pyrene	1666.67	1616.15			97		85-117		
Benzo(b)fluoranthene	1666.67	1518.15			91		78-129		
Benzo(g,h,i)perylene	1666.67	1328.6			80		77-118		
Chrysene	1666.67	1504.28			90		80-121		
Fluorene	1666.67	1570.31			94		86-118		
Naphthalene	1666.67	1516.94			91		82-112		
Phenanthrene	1666.67	1563.3			94		80-114		
Pyrene	1666.67	1445.55			87		81-114		
	mg/kg	mg/kg	mg/kg	mg/kg					
Batch number: 161185708002	Sample number(s): 8347275-8347285								
Lead	15	15.33			102		80-120		
Batch number: 161205711002	Sample number(s): 8347275-8347285								
Mercury	0.100	0.103			103		80-120		
	Std. Units	Std. Units	Std. Units	Std. Units					
Batch number: 16119039401B	Sample number(s): 8347275-8347280								
pH in soil	7.00	7.04			101		95-105		
Batch number: 16119039402A	Sample number(s): 8347281-8347285								
pH in soil	7.00	6.99			100		95-105		
	%	%	%	%					
Batch number: 16118820003A	Sample number(s): 8347275-8347285								
Moisture	89.5	89.44			100		99-101		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ug/kg	MS Spike Added ug/kg	MS Conc ug/kg	MSD Spike Added ug/kg	MSD Conc ug/kg	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 16120SLA026	Sample number(s): 8347275-8347285 UNSPK: 8347285									
Anthracene	59.09	1640.96	1591.68	1663.89	1691.22	93	98	82-118	6	30
Benzo(a)anthracene	115.48	1640.96	1681.43	1663.89	1917.64	95	108	76-119	13	30
Benzo(a)pyrene	89.39	1640.96	1558.45	1663.89	1723.44	90	98	85-117	10	30
Benzo(b)fluoranthene	109.37	1640.96	1479.74	1663.89	1882.12	84	107	78-129	24	30
Benzo(g,h,i)perylene	54.12	1640.96	1507.33	1663.89	1594.92	89	93	77-118	6	30
Chrysene	248.26	1640.96	1617.52	1663.89	1860.87	83	97	80-121	14	30
Fluorene	46.71	1640.96	1482.61	1663.89	1486.41	88	87	86-118	0	30
Naphthalene	30.09	1640.96	1472.89	1663.89	1523.43	88	90	82-112	3	30

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
P###### is indicative of a Background or Unspiked sample that is batch matrix QC and was not performed using a sample from this submission group.

REVISED

Quality Control Summary

Client Name: Evergreen c/o GHD
Reported: 06/21/2016 12:55

Group Number: 1653595

MS/MSD (continued)

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ug/kg	MS Spike Added ug/kg	MS Conc ug/kg	MSD Spike Added ug/kg	MSD Conc ug/kg	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Phenanthrene	360.54	1640.96	1650.51	1663.89	1745.39	79*	83	80-114	6	30
Pyrene	218.48	1640.96	1589.26	1663.89	1770.84	84	93	81-114	11	30
	mg/kg	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**					
Batch number: 161185708002	Sample number(s): 8347275-8347285 UNSPK: P351362									
Lead	654.4	14.85	636.22	14.71	680.12	-122 (2)	175 (2)	75-125	7	20
Batch number: 161205711002	Sample number(s): 8347275-8347285 UNSPK: P355820									
Mercury	38.11	0.156	20.74	0.164	20.56	-11134 (2)	-10679 (2)	80-120	1	20

Laboratory Duplicate

Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	BKG Conc	DUP Conc	DUP RPD	DUP RPD Max
	mg/kg	**mg/kg**		
Batch number: 161185708002	Sample number(s): 8347275-8347285 BKG: P351362			
Lead	654.4	820.69	23*	20
Batch number: 161205711002	Sample number(s): 8347275-8347285 BKG: P355820			
Mercury	38.11	23.42	48* (1)	20
	Std. Units	**Std. Units**		
Batch number: 16119039401B	Sample number(s): 8347275-8347280 BKG: P347270			
pH in soil	7.02	7.02	0	3
Batch number: 16119039402A	Sample number(s): 8347281-8347285 BKG: 8347282			
pH in soil	8.08	8.12	0	3
	%	**%**		
Batch number: 16118820003A	Sample number(s): 8347275-8347285 BKG: P349816			
Moisture	N.D.	N.D.	0 (1)	5

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: VOCs- Solid by 8260B
Batch number: Q161201AA

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
P###### is indicative of a Background or Unspiked sample that is batch matrix QC and was not performed using a sample from this submission group.

REVISED

Quality Control Summary

Client Name: Evergreen c/o GHD
Reported: 06/21/2016 12:55

Group Number: 1653595

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed
unless attributed to dilution or otherwise noted on the Analysis Report.

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
8347278	68	44*	60	75
8347279	81	83	76	75
8347281	81	83	79	69
Blank	93	96	94	91
LCS	95	95	95	94
LCSD	91	91	90	90
Limits:	50-141	54-135	52-141	50-131

Analysis Name: VOCs- Solid by 8260B
Batch number: Q161211AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
8347276	61	41*	52	72
8347283	78	79	79	109
Blank	93	96	92	90
LCS	91	92	92	90
LCSD	91	91	90	89
Limits:	50-141	54-135	52-141	50-131

Analysis Name: VOCs- Solid by 8260B
Batch number: Q161231AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
8347282	77	79	77	104
Blank	92	93	89	89
LCS	97	97	96	93
LCSD	92	93	91	88
Limits:	50-141	54-135	52-141	50-131

Analysis Name: VOCs- Solid by 8260B
Batch number: X161201AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
8347277	120	123	144*	69
8347280	101	96	128	89
8347284	107	108	97	97
8347285	102	100	105	96
Blank	105	98	100	95
LCS	104	100	102	101
LCSD	102	98	102	101
Limits:	50-141	54-135	52-141	50-131

Analysis Name: VOCs- Solid by 8260B
Batch number: X161231AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
8347275	105	108	98	95
Blank	103	98	101	95
LCS	103	98	102	100

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
P###### is indicative of a Background or Unspiked sample that is batch matrix QC and was not performed using a sample from this submission group.

REVISED

Quality Control Summary

Client Name: Evergreen c/o GHD
Group Number: 1653595
Reported: 06/21/2016 12:55

Surrogate Quality Control (continued)

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
LCSD	103	98	102	100
Limits:	50-141	54-135	52-141	50-131

Analysis Name: TCL 8270 (microwave)
Batch number: 16120SLA026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
8347275	81	75	69
8347276	64	57*	59
8347277	94	84	81
8347278	62	39*	32*
8347279	87	76	73
8347280	74	69	63
8347281	106	78	78
8347282	96	66	62
8347283	50*	60*	60
8347284	84	79	71
8347285	90	89	76
Blank	89	81	79
LCS	88	84	79
MS	90	89	79
MSD	89	88	78
Limits:	54-123	63-117	59-129

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
P###### is indicative of a Background or Unspiked sample that is batch matrix QC and was not performed using a sample from this submission group.

Environmental Analysis Request/Chain of Custody

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SOW-1111035 1116979

For Eurofins Lancaster Laboratories Environmental use only

Acct. # 10177 Group # 1653595 Sample # 8347275-85

COC # 499223

Client Information

Client: Evergreen	Acct. #:
Project Name/#: AOI6 AOI8	PWSID #:
Project Manager: David Steele	P.O. #:
Sampler: Matthew Mavas	Quote #:
State where samples were collected: Pennsylvania	For Compliance: Yes ☐ No ☐

For Lab Use Only
FSC:
SCR#: 187565

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

Remarks

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix: Soil	Sediment	Water: Potable	Ground	NPDES	Surface	Other:	Total # of Containers	Analysis Requested: Hg, pH, Pb, SVOC	VOCs, Moisture
BH-16-005-0-2-Soil	4/22/16	1135	✓		✓							5	X	X
BH-16-005-10-11-Soil	4/22/16	1200	✓		✓							5	X	X
BH-16-006-0-2-Soil	4/22/16	1215	✓		✓							5	X	X
BH-16-006-10-12-Soil	4/22/16	1240	✓		✓							5	X	X
BH-16-007-0-2-Soil	4/22/16	1305	✓		✓							5	X	X
BH-16-007-6-7.5-Soil	4/22/16	1320	✓		✓							5	X	X
BH-16-009-0-2-Soil	4/22/16	1110	✓		✓							5	X	X
BH-16-009-5.5-8-Soil	4/22/16	1120	✓		✓							5	X	X
BH-16-008-0-2-Soil	4/22/16	1000	✓		✓							5	X	X
BH-16-011-0-2-Soil	4/12/16	0900	✓		✓							5	X	X

Turnaround Time (TAT) Requested (please circle)
Standard Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Date results are needed: _____

E-mail address: David.Steele@GHD.com

Data Package Options (circle if required)
Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
Bottle Storage	4/14/16	0900	Mark D	4-22-16	1449
Matthew Mavas	4/22/16	1449	Mark D	4-22-16	1449
Mark D	4-22-16	1925			
			Yolanda Gonzalez	4/22/16	1825

EDD Required? Yes No
If yes, format: _____

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS ____ FedEx ____ Other ____

Temperature upon receipt 0.5-0.5 °C 0.8

Environmental Analysis Request/Chain of Custody

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5SOW 1111635 1110979

For Eurofins Lancaster Laboratories Environmental use only

Acct. # 10177 Group # 1653595 Sample # 8347275-85

COC # 499225

Client Information

Client: Evergreen

Acct. #:

Project Name/#: AOI6 / AOI8

PWSID #:

Project Manager: David Steele

P.O. #:

Sampler: Matthew Marcus

Quote #:

State where samples were collected: PA

For Compliance: Yes ☐ No ☐

Matrix

Sediment ☐ Soil ☑ Water: Ground ☐ Potable ☐ Surface ☐ NPDES ☐ Other: ____

Analysis Requested

Preservation Codes

For Lab Use Only

FSC:

SCR#:

Preservation Codes

H=HCl T=Thiosulfate

N=HNO_3 B=NaOH

S=H_2SO_4 O=Other

Remarks

Sample Identification	Collected Date	Collected Time	Grab	Composite	Total # of Containers	Fing, pH, Lead, SVOC	VOC, Moisture
BH16-011-4-5-2011	4/22/16	0935	✓		5	+	+

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Date results are needed: ____

E-mail address: David.Steele@GHD.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
Matthew Marcus	4/22/16	1449	Mach D	4/22/16	1449
Mach D	4/22/16	1825			
			Yonza Jovanday	4/22/16	1825

EDD Required? Yes No

If yes, format: ____

Site-Specific QC (MS/MSD/Dup)? Yes No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS ____ FedEx ____ Other ____

Temperature upon receipt 0.5-0.5 °C 0.8

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The white copy should accompany samples to Eurofins Lancaster Laboratories Environmental. The yellow copy should be retained by the client.

7044 1115

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Sample Administration Receipt Documentation Log

Doc Log ID: 144034

Group Number(s): 1653595

Client: Evergreen

Delivery and Receipt Information

Delivery Method:	ELLE Courier	Arrival Timestamp:	04/22/2016 18:25
Number of Packages:	3	Number of Projects:	1
State/Province of Origin:	PA		

Arrival Condition Summary

Shipping Container Sealed:	No	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	VOA Vial Headspace ≥ 6mm:	N/A
Paperwork Enclosed:	Yes	Total Trip Blank Qty:	0
Samples Intact:	Yes	Air Quality Samples Present:	No
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Maritza Fernandez (9906) at 22:41 on 04/22/2016

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle)* *IR = Infrared (Surface Temp)* *All Temperatures in °C.*

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	DT146	0.5	DT	Wet	Y	Bagged	N
2	DT146	0.5	DT	Wet	Y	Bagged	N
3	DT146	0.8	DT	Wet	Y	Bagged	N

2425 New Holland Pike
Lancaster, PA 17605-2425
T 717-656-2300
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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
µg	microgram(s)	**mg**	milligram(s)
mL	milliliter(s)	**L**	liter(s)
m3	cubic meter(s)	**µL**	microliter(s)
		pg/L	picogram/liter

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Laboratory Data Qualifiers:

B - Analyte detected in the blank
C - Result confirmed by reanalysis
E - Concentration exceeds the calibration range
J (or G, I, X) - estimated value ≥ the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P - Concentration difference between the primary and confirmation column >40%. The lower result is reported.
U - Analyte was not detected at the value indicated
V - Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference…

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

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Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

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